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OCTOBER 2002
ISSUE 144

Tips, Tools, Techniques, and Projects for the Home Woodworker

raised-panel doors made easy
3 bits do it all

11 GREAT PROJECTS

7 BANDSAWS TESTED
See which ones make the cut!

EXCLUSIVE

Kids' bunk beds and dresser plans

18 WORKSHOP SOLUTIONS
- mobile rack organizes your lumber, p.72
- compact carousel holds tons of tools, p.64
- customized holders protect sharp tools, p.12
- new router bits for tricky joints, p.20
- plus 14 shop tips!

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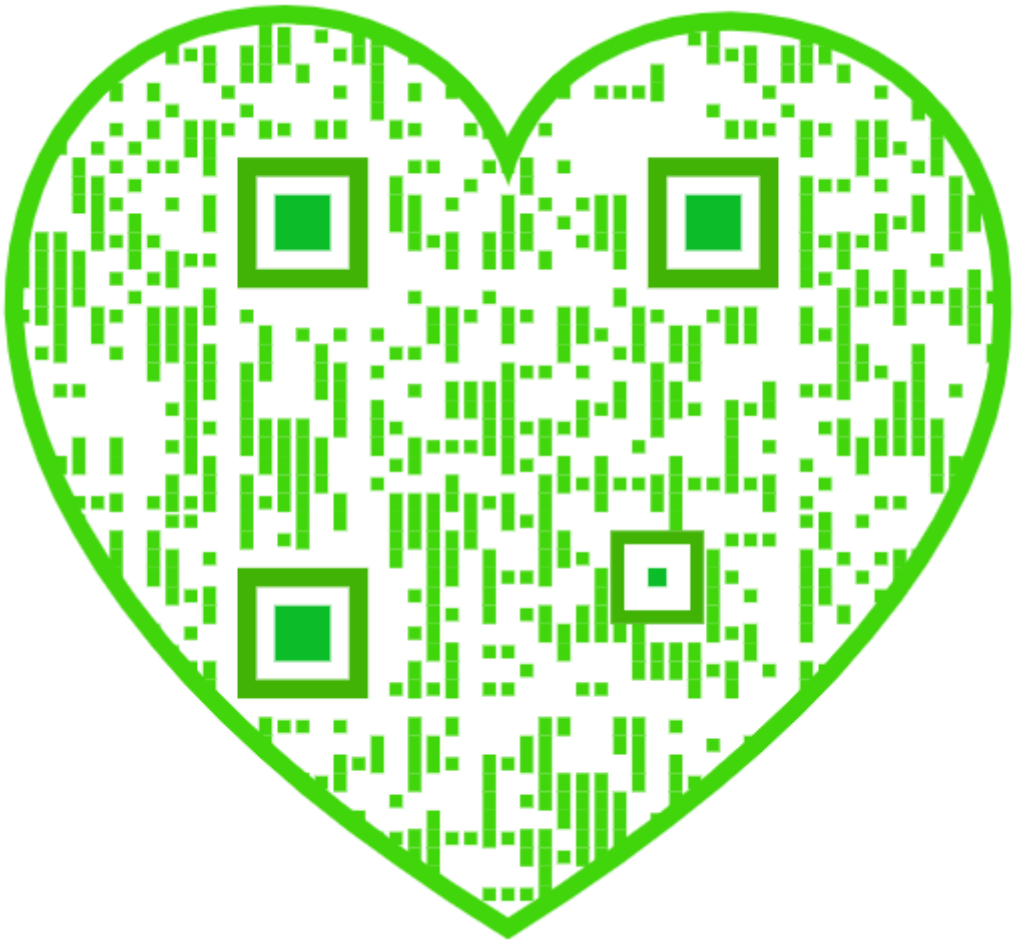

This seal is your assurance that we build every project, verify every fact, and test every reviewed tool in our workshop to guarantee your success and complete satisfaction.

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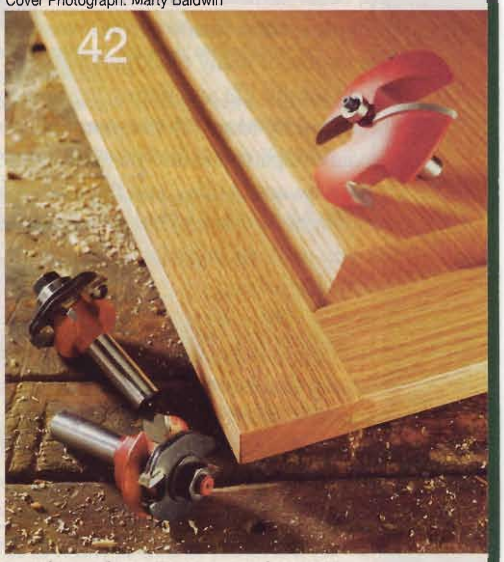
Cover Photograph: Marty Baldwin



editor's angle

What I'd like you to know about us

In today's business world of multi-national conglomerates and venture partnerships, it's getting harder to know just who stands behind the products you buy every day. But there's no mystery about the publisher of *WOOD* magazine: Meredith Corporation. It's a big company for sure, but one with a woodworker as chairman of its executive committee.

During a recent visit to Ted Meredith's workshop, I had a chance to look over a large platter Ted fashioned from a box elder burl.

Have you wondered why the *Better Homes and Gardens* brand appears above *WOOD* on our cover? Or how our parent company, Meredith Corporation, got its start?

We include the *BH&G* brand above the *WOOD* logo because of the recognition and trust it carries for new readers who may not be as familiar with us as long-time subscribers. *BH&G* is the largest of many other publications about family life and improving homes produced by Meredith Corporation, a media company that also owns TV stations.

So why am I telling you this? I thought you might be curious, but also I want to let you in on an important anniversary that we're celebrating.

It was 100 years ago when E.T. Meredith founded his publishing company with the first issue of *Successful Farming* magazine (which is still published today). The next magazine in the Meredith stable came along in 1922 with the publication of *Fruit, Garden and Home* (which became *Better Homes and Gardens* in 1924).

Today, E.T.'s grandson, Ted Meredith, who I am happy to tell you is a dedicated woodworker, serves the company as Chairman of the Executive Committee. Ted has built some ambitious projects in his garage workshop over the years, including a biplane and two boats. His current project is the restoration of a 1930s-vintage plane, a task with no shortage of woodworking challenges, judging by the curved and veneered instrument panels on Ted's workbench.

As we mark this anniversary, it is my sincere wish that we continue to serve your needs for many years to come.

Bill Krier

Better Homes and Gardens® WOOD®

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sounding board

Our bulletin board for letters, comments, and timely updates

Flag cases touch recipients and builders

Reader Ed Sallee (*back left*) was honored to build flag cases in memory of Captain Victor Saracini, and proud to present them to Ellen Saracini and daughters Kirsten and Brielle. A plaque in the upper left portion of each case bears a memorial and pilot's wings.

I am a subscriber to your magazine, and have built many of your featured projects. Little did I know what was in store for me when I received the April 2002 issue. My roller coaster of emotions began when the magazine arrived.

In that issue, you featured an article (page 14) on Woodworkers United For America (WUFA). This group formed with the purpose of providing flag cases to any family member of those who perished as a result of terrorist activities on September 11, 2001.

I contacted Mr. George Dubois, the National Director of WUFA and expressed my desire to build a couple of flag cases. George assigned me the privilege of making flag cases for the family of Captain Victor Saracini: his wife, Ellen; two daughters, Kirsten and Brielle; and his mother, Anne. Captain Saracini was the pilot of United Airlines Flight 175, the second plane to hit the World Trade Center.

I can't begin to tell you how honored I was to share my love of woodworking in such a manner. Thank you for bringing this wonderful program to my attention.

I delivered the cases to Mrs. Saracini this past spring (see the photo, *above*). She and her daughters were wonderful.

I'd like to thank everyone who helped me with the cases. And thanks to my employer, McCollister's Transportation Systems, Inc. of Burlington, New Jersey, for transporting cases to New York from various WUFA chapters.

—Edward Sallee, Burlington, N.J.

A new woodworking contest that's literally "For the Birds"

Here's your chance to win great prizes and do a good turn for your fine-feathered friends as well. *WOOD*® magazine has teamed up with Chevrolet and other prize sponsors to host our first-ever birdhouse/bird feeder contest, providing $8,000 in total prizes, with $5,000 being awarded to the Grand Prize Winner.

To enter, simply build a birdhouse or bird feeder that fits one of the seven prize categories explained with our entry form on *page 97*. Choose a favorite existing plan, or come up with something entirely original, we'll offer prizes for both types of projects. Include an entry form with each birdhouse or bird feeder (you can submit up to seven total entries) and mail it to *WOOD* magazine's "For the Birds" contest before the February 1, 2003 deadline.

After we judge the entries and award the prizes, we'll auction the birdhouses and bird feeders and turn the proceeds over to the National Wildlife Federation's Backyard Wildlife Habitat program. Since 1973, this program has helped people garden for wildlife. The program encourages everyone—homeowners and community leaders alike—to plan their landscaping with the needs of wildlife in mind, while offering abundant help in how to do it.

The NWF ranks as the nation's largest member-supported conservation group, uniting individuals, organizations, businesses, and government to protect wildlife, wild places, and the environment. For more on the NWF and its programs, visit its Web site at http://www.nwf.org.

Tool-test update

•Stowable Sawhorses (issue 142, p. 72):

The Web site for The Stanley Works is www.stanleyworks.com.

Article information online

Do you have a question on a project? You'll find a complete listing, from issue 1 through today, of all known updates to past *WOOD* magazine projects on our Web site at **www.woodmagazine.com**. Just click on *WOOD* magazine on the left side of the screen. Then select Editorial Extras from the options on the next screen.

Write Us!

Do you have comments, criticisms, suggestions, or maybe even a compliment specifically relating to an article that appeared in *WOOD*® magazine? Please write to:

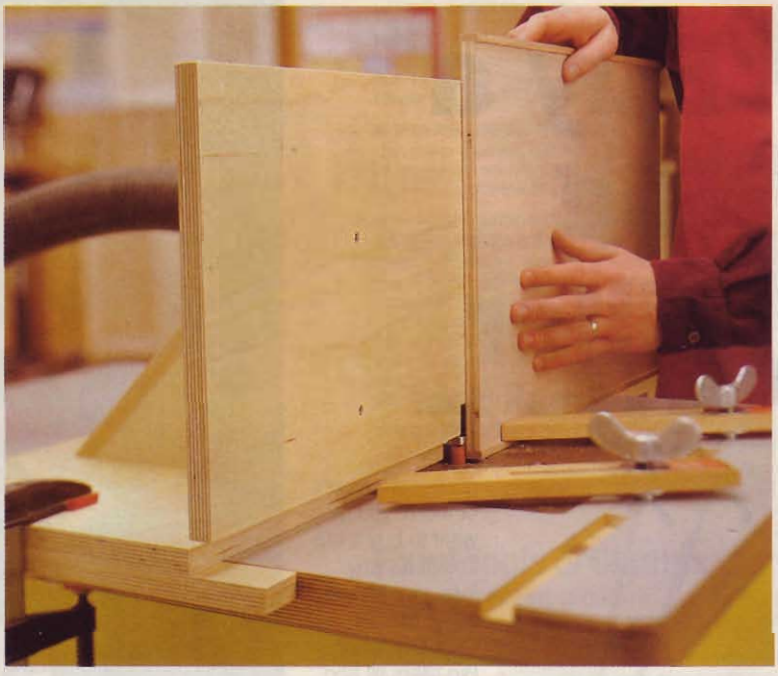
Sounding Board
***WOOD* magazine**
1716 Locust St., GA-310
Des Moines, IA 50309-3023

or, if you prefer, send us an e-mail message at **soundingboard@woodmagazine.com.**

Due to the volume of letters and e-mails we receive, we can respond to and publish only those of the greatest interest to our readers.

flush-trimming fence

A simple router-table setup for putting a finished edge on plywood panels.



While building the child's dresser, shown on *page 58*, project builder Chuck Hedlund had to do a lot of flush trimming on the solid-wood edging that dresses up the plywood panels. He needed a foolproof way to get the job done. A handheld router with a flush-trim bit works, but it's easy to accidentally tip the router and gouge the edging and plywood. Chuck solved the problem with the router-table-mounted fence shown in the photo, *above right*.

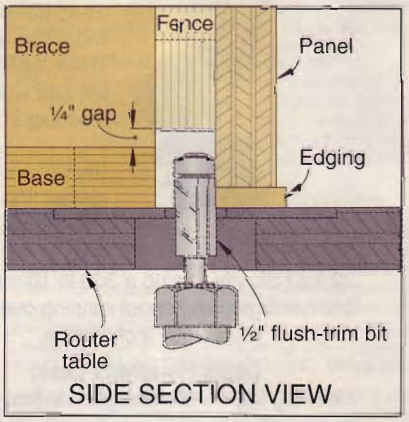
Made of ¾" plywood, the fence sits perpendicular to the table, as shown at *right*. The lower edge of the fence is mounted 1" above the router-table surface, so it accommodates edging up to ¾" thick.

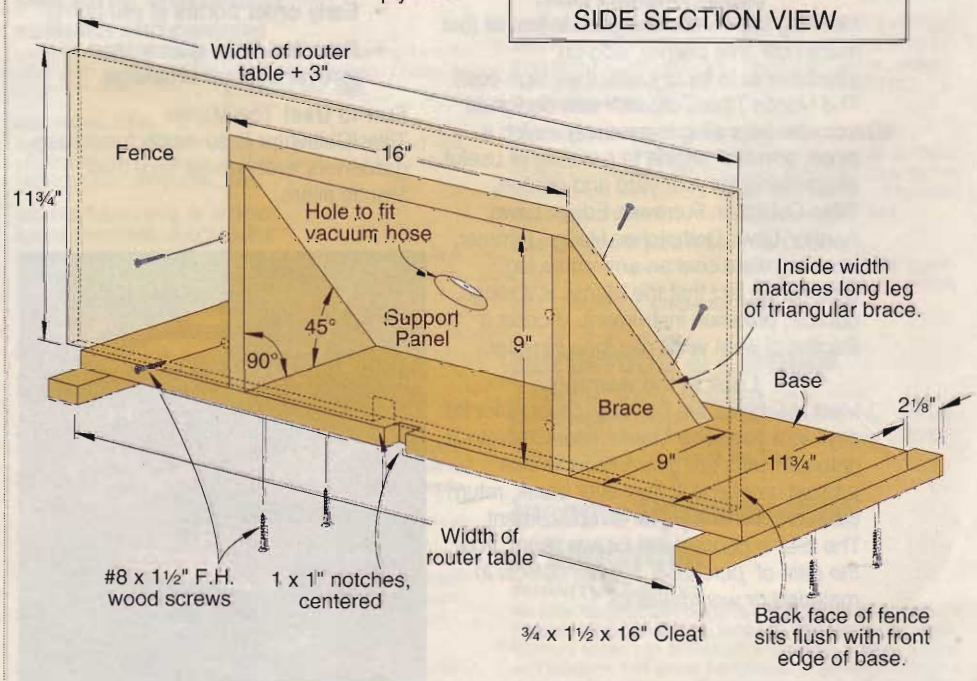
To build the project, cut its identically sized fence and base to 11¾" wide. Measure your router table to determine the length. Then cut matching notches in the base and fence, positioned to align with the bit hole in your table. Two triangular braces hold the base and fence together. The cleats at each end help position the assembly on your router table.

Chuck also added a support panel to the braces that stiffens the entire assembly. A hole cut into the support accepts a shop-vacuum hose to collect chips.

To use the fence, install a flush-trim bit in your table-mounted router. Align the fence face flush with the bit's pilot bearing, and clamp the fence down. Hold the edged plywood firmly against the fence as you make each pass, and the edging comes out perfectly flush every time.

Written by **David Stone**
Project design: **Charles I. Hedlund**
Illustrations: **Roxanne LeMoine**
Photograph: **Marty Baldwin**





safe storage for chisels

Create a custom insert to protect sharp edges.

Keep your chisels safe from damage, well organized, and looking good with a simple series of felt-lined dadoes.

When we designed the "Craftsman's Pride Tool Chest" in issue 142, we lined the drawer bottoms with felt. Here's how to add extra protection for a set of chisels.

Plan the layout

Add up the handle diameters of the chisels you want to store, and subtract the total from the inside width of the drawer. Divide that number by the spaces that you'll need to get an approximate spacing distance. Our set includes 10 chisels, so we needed to account for 11 spaces. You can vary the spacing by making the end spaces bigger or smaller than the others.

Make the supports

Place your longest chisel with the handle flat on your workbench, and measure the gaps beneath the ferrule and the blade. Also measure the length of the blade. Now, make blade and ferrule supports to match those dimensions.

For the blade support, plane a board to ⅝" thickness, rip it to 4¾", then cut it to a length 1/16" less than the width of the drawer. For the ferrule support, rip a strip 1" wide. Plane it to ½" thickness, and cut it to the width of the drawer. Mark the handle center points on the edge of each support. Extend the points across the ferrule support.

Make a customized recess for each chisel by marking on the edge of the blade support the width of each blade plus 1/16", centered on the previously marked points. At your tablesaw, set a dado blade to cut ¼" deep, and cut a dado between each set of marks. Use the appropriate chisel and a scrap of felt to test for a snug fit.

Using a bit of the same diameter as the ferrule (we used a ¾" Forstner), drill a hole at each line on the ferrule support stock. To do this, clamp a fence on your drill-press table to keep the holes lined up, and locate the fence so that the holes will hold the ferrules at the desired height. (In our case, we centered the holes ½" from the edge to leave ⅛" of wood under each ferrule.) After drilling the holes, sand both faces. Rip the stock through the center of the holes to leave a series of notches.

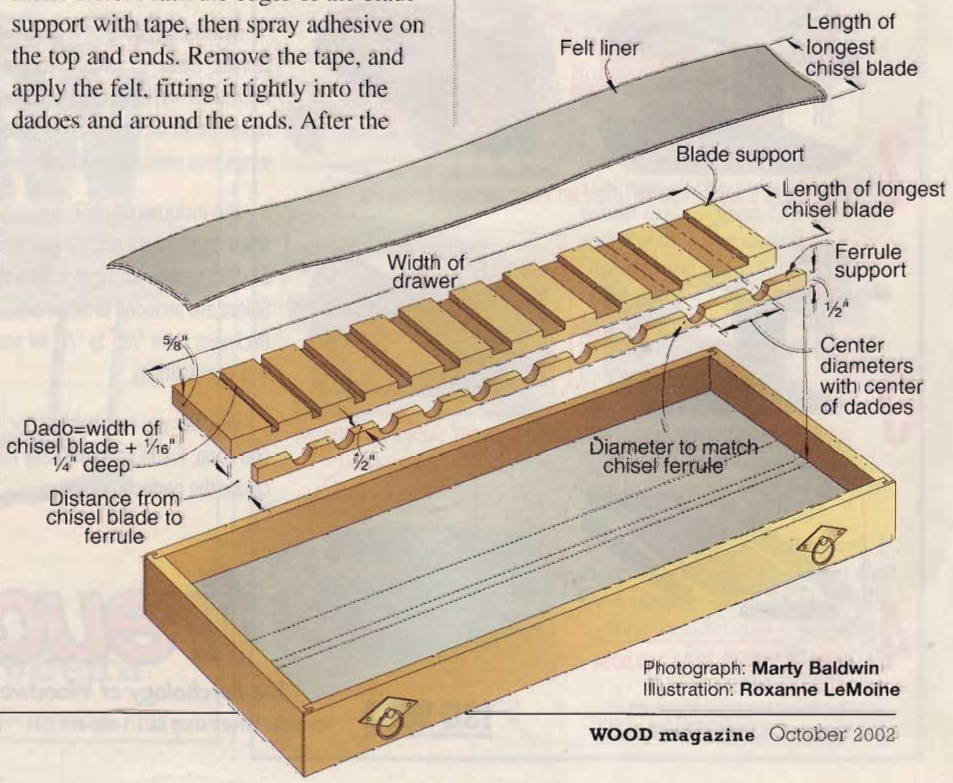
Add finish and felt

Apply a stain or clear finish to match the tool chest or storage unit. Coat the top and sides of the ferrule support, but only the front edge of the blade support.

Cut an oversized piece of felt from the fabric store. Mask the edges of the blade support with tape, then spray adhesive on the top and ends. Remove the tape, and apply the felt, fitting it tightly into the dadoes and around the ends. After the adhesive sets, turn the support upside-down, and trim the felt along the edges and the ends with a knife.

If your drawer bottom is unlined, cut a piece of poster board ⅛" smaller in length and width than the inside dimensions of the drawer. Apply double-faced tape to the bottom of the poster board around its perimeter. Cut felt 2" larger in length and width than the poster board. Center the poster board, top down, on the felt, trim off the corners of the felt, and fold it onto the tape. Flip the poster board over, and press it into the drawer.

Place strips of cloth-backed, double-faced tape on the blade support bottom, and press it into the drawer. Finally, apply double-faced tape to the bottom of the ferrule support, and press it into place.



Photograph: **Marty Baldwin**
Illustration: **Roxanne LeMoine**

A quick turn-around project...

salt & pepper shakers

Dust off your lathe, choose any wood—ordinary to exotic—and you'll have this set finished in an afternoon.

Ambrosia—bounty to woodturners

We made these shakers from ambrosia maple. Nothing more than soft maple, this wood derives its color and name from the ambrosia beetle, a wood-boring insect. The beetle in turn takes its name from its favorite food: ambrosia fungus.

The ambrosia beetle, only about ¼" long, bores pin-hole tunnels into dying trees and freshly cut logs and lumber. It does not consume the wood. Instead, it introduces two types of fungus. One, the ambrosia fungus, grows in the tunnels and is eaten by the beetle. The other, a staining fungus, gives the wood its distinctive greenish-gray to bluish-black swirling bands.

Because it needs the moisture in green wood to survive, you won't have to worry about beetles living in your dried turning square.

Add some spice to mealtimes with this pleasingly plump turned shaker set. All you need is a lathe, a couple of Forstner bits, and basic turning skills to form these attractive dining accessories in a dash. We turned this set from an unusual type of maple (see the sidebar, *left*), but any species will do.

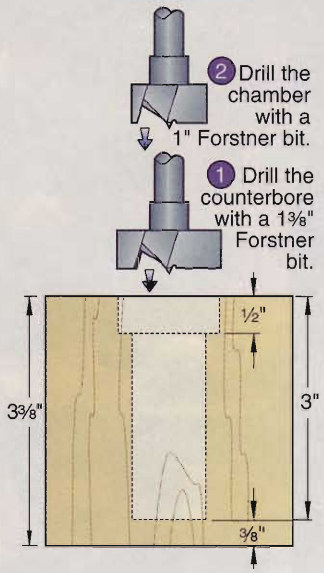
For the items needed to build this project, see Tools and Accessories and the Buying Guide on *page 18.*

Continued on page 16

Bore the blanks, and make a jam chuck

1 Bore the chambers

From a 3×3×8" turning square, cut two 3⅜"-long shaker blanks. Find the centers by drawing diagonals on both ends of each blank. Chuck a 1⅜" Forstner bit in your drill press. Holding the blanks in a handscrew clamp, drill centered ½"-deep counterbores in their bottoms. Change to a 1" Forstner bit, and set the depth stop to drill within ⅜" of the bottom of each blank. Centering the bit in the counterbores, drill the chambers.

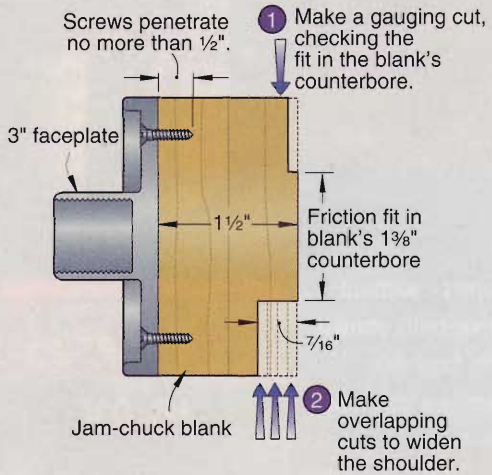


Tools: Drill press, 1" and 1⅜" Forstner bits
Speed: 500 rpm for the 1" bit, 250 rpm for the 1⅜" bit

2 Fabricate a jam chuck

Laminate two ¾×3½×3½" pieces of hardwood scrap to make a 1½"-thick jam-chuck blank. Center your 3" faceplate on the blank, trace around it, and bandsaw to the line. Drill pilot holes, and screw the faceplate to the blank. The screws should penetrate no more than ½" into the jam-chuck blank. Mount the faceplate on your lathe. Using your parting tool, make a gauging cut at the blank's edge, turning a ⅛" shoulder that fits tightly into the shaker blank's counterbore. Making overlapping cuts with your parting tool, widen the shoulder to 7/16", maintaining a snug fit in the blank's counterbore.

Tools: Parting tool
Tool rest: Center
Speed: 800–1,200 rpm


Screws penetrate no more than ½".
1 Make a gauging cut, checking the fit in the blank's counterbore.
3" faceplate
1½"
Friction fit in blank's 1⅜" counterbore
7/16"
Jam-chuck blank
2 Make overlapping cuts to widen the shoulder.

Turn the shakers

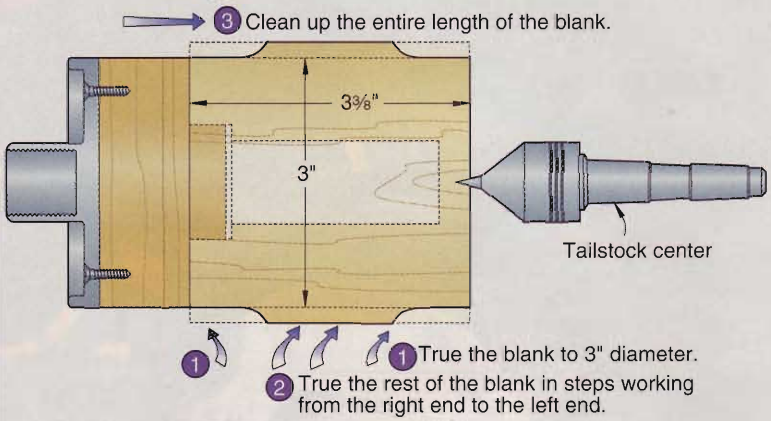
1 Make the template

Make a copy of the shaker template full-size pattern on the *WOOD PATTERNS*® insert. Use spray adhesive to adhere the pattern to a ⅛×2¼×4" piece of tempered hardboard. Bandsaw and sand the template to the pattern line.

2 True the blanks

Mount the first blank on the jam chuck. Make sure the blank sits completely flat on the chuck. Engage the tailstock center. Use your ⅜" bowl gouge to shape the blank into a 3"-diameter cylinder.

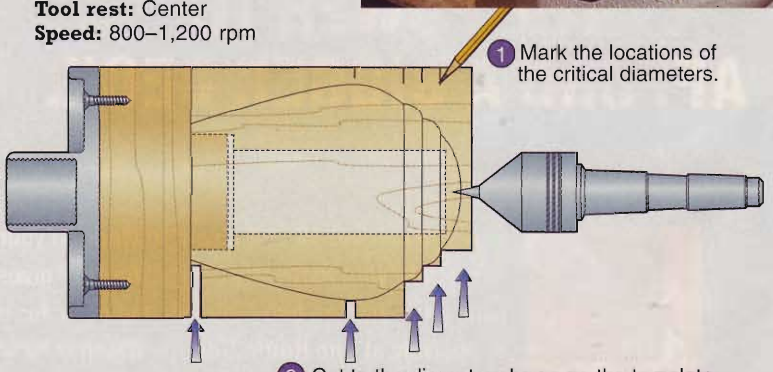
Tools: Bowl gouge
Tool rest: Below center
Speed: 600–800 rpm


3 Clean up the entire length of the blank.
3⅜"
3"
Tailstock center
1
1 True the blank to 3" diameter.
2 True the rest of the blank in steps working from the right end to the left end.

3 Make gauging cuts

Lay the template on the blank, aligning the bottom of the shaker profile with the blank's bottom edge. Mark the locations of the critical diameters. Using a parting tool and outside calipers, make gauging cuts in the blank to the diameters indicated on the template, as shown in the photo, *right*.

Tools: Parting tool, calipers
Tool rest: Center
Speed: 800–1,200 rpm

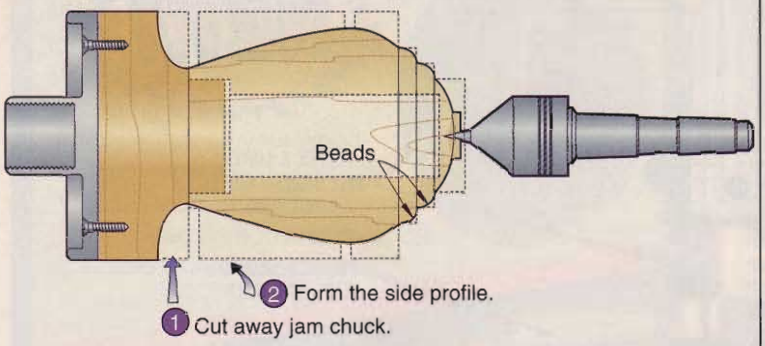


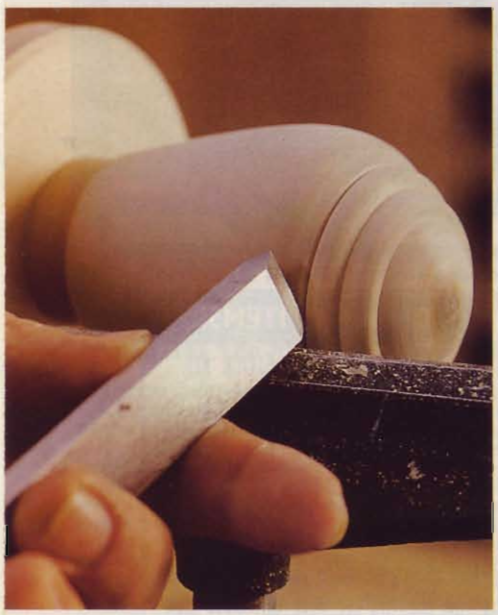
Continued on page 18

4 Form the side profile

Using a ⅜" spindle gouge, form the side profile on the shaker's lower section. Cut away the jam chuck, where shown, to provide clearance for your turning tool, and later for checking the profile with the pattern.

Tool: Spindle gouge
Tool rest: Slightly below center
Speed: 1,200–1,600 rpm

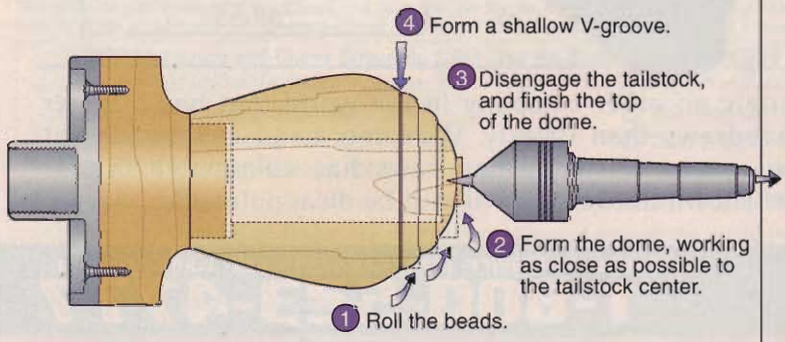




5 Roll the beads

Roll the beads with your parting tool. Switch to your ¾" skew chisel, and form the domed top, cutting as close to the tailstock center as possible. Disengage the tailstock, and finish the top of the dome. Form a slight V-groove at the base of the lower bead, as shown in the photo, *left*. Check your profile with the template.

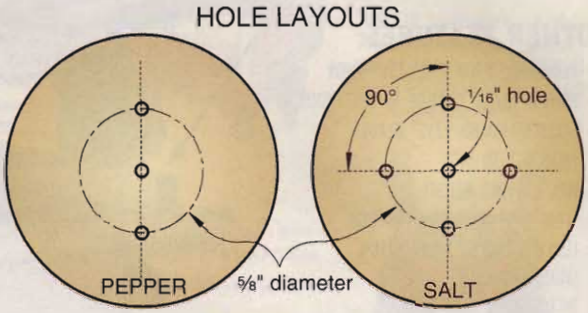
Tools: Parting tool, skew chisel
Tool rest: Slightly above center
Speed: 800–1,200 rpm


4 Form a shallow V-groove.
3 Disengage the tailstock, and finish the top of the dome.
2 Form the dome, working as close as possible to the tailstock center.
1 Roll the beads.

Finishing up

1 Drill the shaker holes

With the lathe running, use a pencil to mark the center and a ⅝"-diameter circle centered on the dome top. Stop the lathe. Using your toolrest as a straightedge, mark 90° "crosshairs" through the centerpoint to locate the holes for the salt shaker. (Draw a single straight line through the center for the pepper shaker.) Remove the shaker from the jam chuck. To keep the drill bit from wandering on the curved surface, mark hole locations with an awl at the center and where the lines intersect the circle. Chuck a 1/16" bit in your drill press and drill the holes through the dome into the chamber.



2 Apply the finish

Remount the shaker on the jam chuck. Sand the shaker with a progression of 120- 220- 320-grit sandpapers. Apply a clear finish. We used Mylands Friction Polish, following the directions on the bottle. When the finish dries, clear the shaker holes by twisting a 1/16" drill bit through them. Repeat the turning and finishing steps with the other shaker blank. For quick recognition, stain the pepper shaker before applying the clear finish. We used ZAR no. 113 Fruitwood stain. To absorb the latent moisture in the wood and keep the salt and pepper dry, add a teaspoon of dry rice grains to the shakers when filling them. Push the rubber bungs into the bottoms of the chambers. See the Buying Guide for our source for the finish, bungs, and turning blank.

Tools and Accessories: 3" faceplate, ⅜" bowl gouge, parting tool, ⅜" spindle gouge, ¾" skew chisel, outside calipers, and 1" and 1⅜" Forstner bits.

Buying Guide

Finish and bungs. Mylands High Build Friction Polish (4-ounce bottle) no. 949-4000, $5.50 ppd.; rubber bungs for 1" holes (2), kit no. 923-0148, $9.99 ppd. Available from source listed *below*.

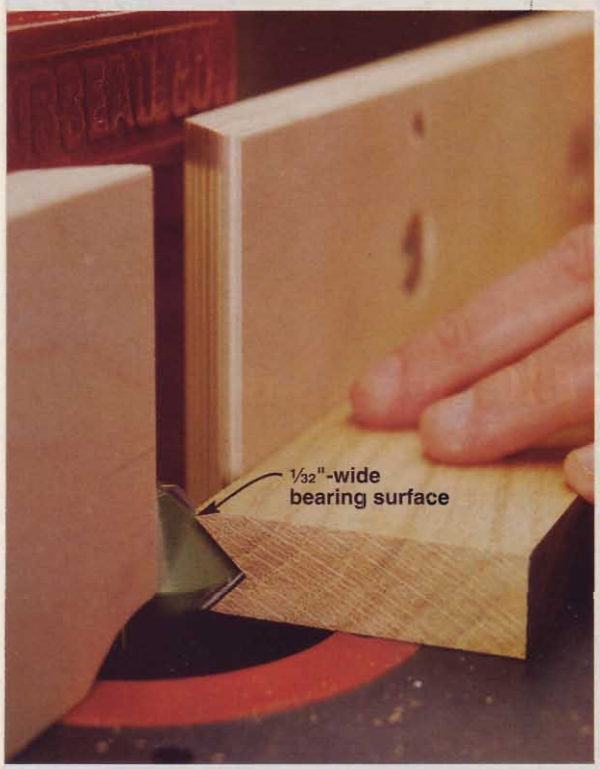
Finish, bungs, and wood. Items above plus the 3x3x8" turning square listed. Ash no. 901-8700, $13.99 ppd.; maple no. 901-8701, $13.99 ppd.; walnut no. 901-8702, $15.99 ppd., ambrosia maple no. 901-8703, $15.99 ppd. Prices reflect a 10 percent discount to *WOOD*® magazine readers. Craft Supplies USA. Call 800/551-8876, or go to www.woodturnerscatalog.com.

Written by **Jan Svec** with **Phil Brennion** and **Jeff Mertz**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**
Photographs: **Marty Baldwin**

bird's-mouth bits

Making cones, columns, or cylinders is a barrel of fun and requires little monkeying around when you use one of these unique cutters.

Wooden-boat builders have long used "bird's-mouth" joinery to construct hollow masts and booms. We landlubbers can take advantage of this strong edge-to-edge joint, shown at *top right*, when making cylindrical objects, such as columns, arched chest lids, or turned vessels.



Leave a small, flat bearing surface above (or below) the cutter for the workpiece to ride against the outfeed fence. This "rib" can be sanded or hand-planed away after assembly, or left intact for a decorative effect.

The bird's-mouth joint tops a miter joint for a number of reasons: First, introducing the cutaway "mouth" creates more gluing surface. Secondly, the mouth cradles the mating workpiece, making it nearly impossible for the joint to slip out of alignment during a glue-up. Finally, you cut only one side of the joint, so you reduce your machining time—and chance for error—by half.

A router bit makes the joint foolproof

Boatbuilders make the bird's-mouth joint on very long pieces using a tablesaw. As with any multi-faceted project, though, a tiny error in the cutting angle can become huge when compounded at each joint. You'll reduce your error rate to near nil, however, when you machine your workpieces with a bird's-mouth router bit (Lee Valley Tools, www.leevalley.com, or 800/871-8158). By fixing the cutting angle at the factory, these bits virtually guarantee your success when making 6-, 8-, 12-, or 16-sided cylinders.

So, how many sides do you need? That depends ultimately on the nature of the project. The more sides in your cylinder, the smoother the curve. If you plan to turn the cylinder blank round, more sides also mean less waste, because you can use thinner stock to construct the blank. On the other hand, if you want the cylinder to have an angular, faceted look, use fewer sides.

For a simple column, setting up to use the bit is as simple as the joint is strong. In your router table, install the proper bit for the number of sides (or *staves*) in your cylinder. Set the bit's cutting height to leave a small (say, 1/32"), flat bearing surface on the workpiece, as shown in the photo at *left*.

After routing all the staves for the cylinder, apply glue to the routed edges, stand the staves on end, and clamp them together with band clamps. If you have a lot of sides to assemble, a pair of scrapwood discs that fit inside the cylinder will help keep it round.

Think outside the cylinder

Want to be a little more creative? You can use the joint to decorate and "break" the edges of a case or chest, as shown in the photo on *page 22*. Or, if you're up for a challenge, use bird's-mouth bits to create tapered cylinders or cones, like the ones illustrated on *page 22*.

Things start to get a little tricky here, though, as the number of staves in the cone doesn't necessarily match the number of the cutter. (For example, the 12-side cutter can be used to cut cones with 3–12 staves.) The fewer the staves,

Continued on page 22

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the flatter the cone—a 3-sided cone looks like a squashed pyramid, while an 11-sided cone is nearly a cylinder. You will need to do some figuring to determine the cutting angles for the staves. Detailed instructions and simple formulas for making the calculations come with the bits.

Before you buy, we encourage you to view the instruction manual on Lee Valley's Web site. At $26 each, these three bits (one for 8-, one for 16-, and one for 6- and 12-sided cylinders) aren't budget breakers, but you'll want to make sure you get the right bit for your project.

Written by **Dave Campbell** with **Jeff Mertz**
Photographs: **Marty Baldwin**
Illustration: **Tim Cahill**

Use a bird's-mouth bit to soften (or highlight) the corner joints of a large project, such as an entertainment center.

BIRD'S-MOUTH BITS CAN MAKE THESE SHAPES AND MORE

child-safe bunk beds

Bunk beds save space—a welcome feature for a young, growing family. Equally important is that they are designed with safety in mind. Here's what you need to know before you plan your own bunk beds or modify existing plans.

Safety standards for bunk beds were adopted by the U.S. Consumer Products Safety Commission in 1999. These standards apply to any bed having the underside of its foundation more than 30" above the floor. For the complete text of the standards, including methods of testing for compliance, go to the CPSC Web site at www.cpsc.gov. Click on search, and type in "bunk bed standards." Click on "Safety Standard for Bunk Beds." You'll need Adobe Acrobat to view the document.

To make it easier to understand these standards, we've boiled them down to nine key points:

(1) Two guardrails are required. If a ladder is attached to one side, the guardrail on the other side must be continuous.

(2) The gap between the continuous guardrail and the end structures cannot exceed 7⁄32".

(3) A maximum gap of 15" in one guardrail is allowed for ladder access.

(4) Guardrails must be attached to the bed in a manner that prevents accidental dislodging or intentional removal by a child.

(5) The top of the guardrails must be at least 5" above the top of the mattress.

(6) The upper edge of the upper bunk end structures must be at least 5" above the top of the mattress for at least 50 percent of the distance between the corner posts.

(7) With the mattress removed, any opening in these areas on both side and both end structures of the upper bunk must be small enough to prevent the passage of a 3½"-diameter rigid sphere.

(8) With the mattress removed, any opening in this area of the end structures of the lower bunk must be small enough to prevent the passage of a 3½"-diameter rigid sphere or large enough to allow the passage of a 9"-diameter rigid sphere.

(9) With the mattress removed, any opening in this area of the end structures of the lower bunk large enough to allow the passage of a 9"-diameter rigid sphere must be configured to avoid the entrapment of a child's neck.

Note: *While not a requirement of the CPSC standard, we recommend screwing the mattress platforms to the bedrails.*

Illustration: **Roxanne LeMoine, Lorna Johnson**

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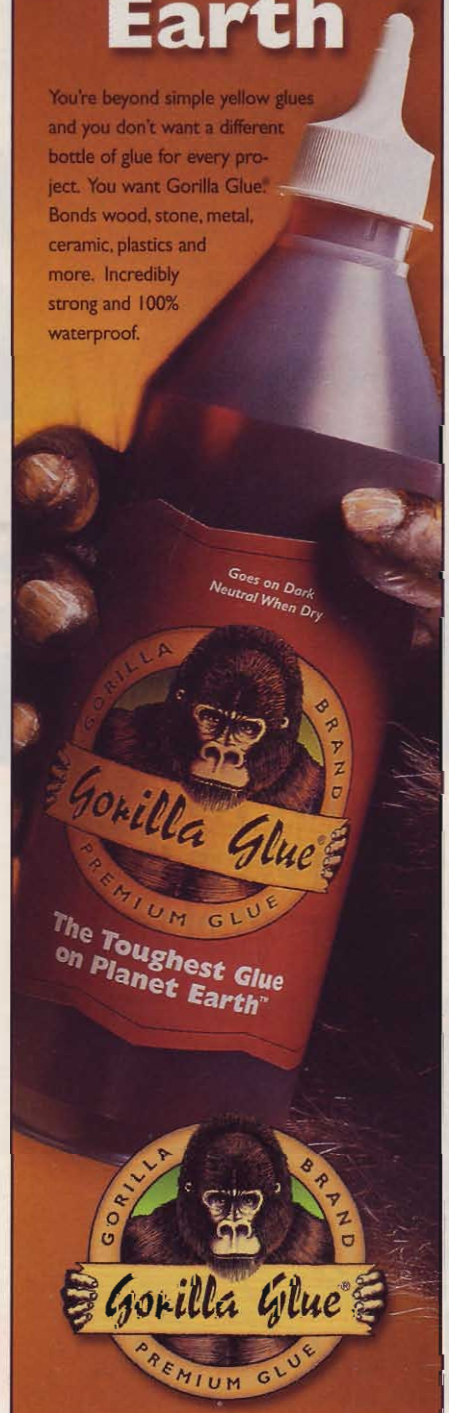

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Circle No. 50

short cuts

News and notes from the woodworking world

Do you have a yen for yesterday's tools?

Your father gave you an old wooden molding plane; your great-uncle left you a century-old handsaw. At a garage sale down the street, you bought up a pair of wooden handscrews for next to nothing. Somewhere along the way you caught the antique-tool-collecting bug, but where do you go from here? Try the Mid-West Tool Collectors Association.

Begun in Chicago in 1968 with just 16 members, the M-WTCA has since blossomed into an organization of 4,000. But don't let the name fool you: Membership spans all 50 states and six countries.

A great association you can join

According to the mission statement, the M-WTCA dedicates itself "to the study, preservation, and understanding of the early tools, implements, and devices used by our ancestors in their homes, shops, on the farms, and on the seas, and to a better perception of the industries and crafts in which these tools were used." That means more than just woodworking tools, though these tools play a significant part.

A membership fee of $25 per year ($33 for Canada and $40 for other countries) entitles you to several worthwhile benefits. You get a subscription to *THE GRIST-MILL*, a quarterly magazine containing educational articles on tool collecting. You receive reprints of out-of-print tool-related literature, trade manuals, and catalogs. And, finally, you can attend the area meetings held in any of the 18 geographic locations, or the biannual national meetings.

These meetings include tours to museums and restorations, lectures, seminars, and films and demonstrations of early crafts. They also provide space where members can display their special collections, and bring along antique tools for sale and trade.

For an application form, or more information on M-WTCA, write to Mid-West Tool Collectors Association, Inc., P.O. Box 8016, Berkeley, CA 94707, USA, or go to their Web site at www.mwtca.org and see their home page.

Photograph by John G. Wells

As a member of the M-WTCA, not only can you research antique tools, such as these, you develop friendships with like-minded collectors that can last a lifetime.

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Bamboo

The "wood" that comes from grass

Few Westerners think of bamboo as anything but a houseplant, garden accent, or snack for a panda. But throughout much of the world, bamboo provides durable building material. Soon, more of us in the United States may find bamboo right under our feet, literally, as bamboo flooring is a hot new trend.

Surprisingly, bamboo isn't even wood—it's grass, and an amazing grass at that. These prolific, tree-like plants (hundreds of varieties exist) grow incredibly fast. Plants reach harvesting size (around 20') in 3–5 years, then regrow after cutting.

Bamboo flooring, *above*, consists of stalks (called culms) cut into strips, planed to about 3/16" thick, and glued into planks. In the "horizontal" style, strips about 1" wide are laminated in two-or three layers. In "vertical" planks, the strips are face-glued, which exposes the culms' edges. Planks join using tongues and grooves.

Bamboo's natural color is light tan. Heating the stalks "carbonizes" and darkens them. The flooring cross-sections, *top*, show "vertical" planks (left) and "horizontal" (right). Planks measure 3⅝×36".

The result is a beautiful, even-toned floor without knots or wild grain. Instead, just thin, straight lines remain, interrupted only by subtle markings at the culm joints.

More surprising than bamboo's looks is its strength. A bamboo floor provides 50 percent more dimensional stability than red oak, and rivals maple in hardness.

Bamboo has a light hue, but takes on a caramel tone when the stalks are heated and "carbonized." The color runs throughout, eliminating the need for stain.

Not all flooring retailers stock bamboo, but it is getting more common. Pricing compares to maple, at $5–$7 per square foot, uninstalled.

As bamboo gains popularity, look for more products made from these versatile plants, such as door panels, veneered plywood, and even laminated "boards" for furniture.

After harvest, bamboo plants regenerate from the existing stalks. This accelerates new growth and eliminates the need for replanting.

Written by **David Stone** with **Peter J. Stephano**
Photographs: **Marty Baldwin**

shop tips

Helping you work faster, smarter, and safer

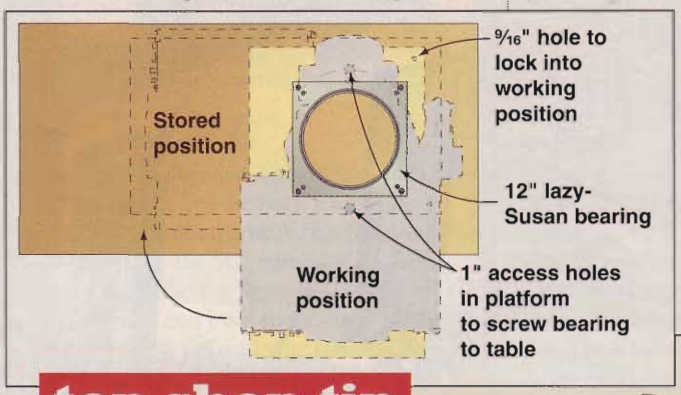
Sander swings into action, swivels to stow

Sometimes a benchtop power tool, such as a drum sander, stores efficiently facing one direction, but must be rotated to go to work. Other times, such as with a belt/disc sander, there are two working positions. I solved these problems by creating a benchtop platform that rotates on a lazy-Susan bearing. Here's how you can, too.

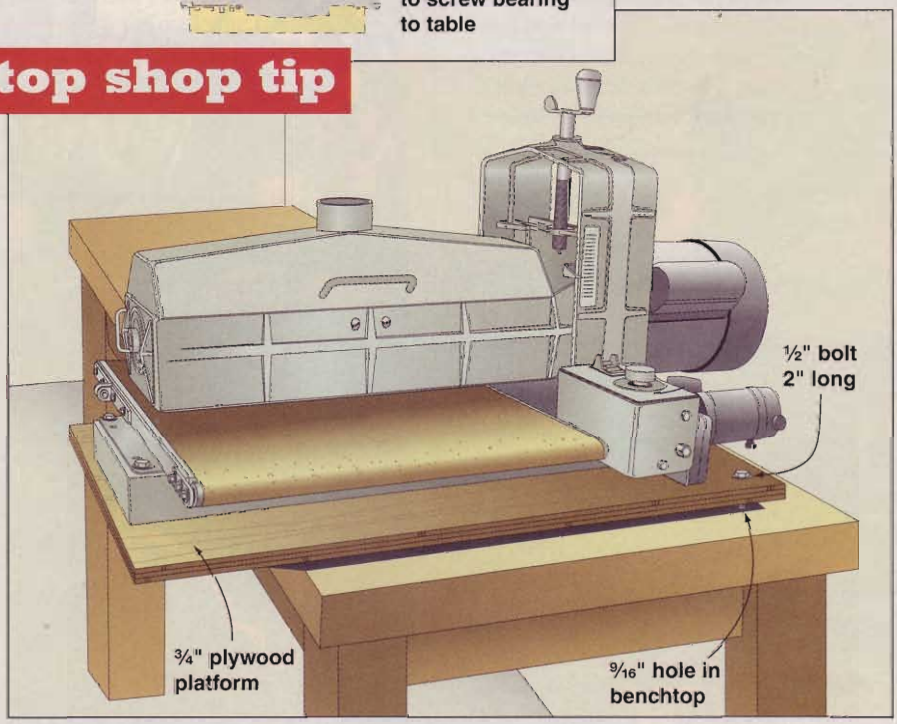
Cut the platform from ¾" plywood. Drill holes through it for the mounting bolts, and install T-nuts on the underside of the platform. Test-fit the tool, making certain that the bolts don't protrude more than ¼", or they will drag on the bench. If they do, buy shorter bolts or hacksaw them to length.

Remove the tool, and screw the lazy-Susan bearing to the bottom of the platform. Drill 1" access holes through the platform, and screw the assembly to your bench. Mount the tool, and rotate it into its working position. Drill a 9/16" hole near one corner of the base and into your bench to accept a bolt that keeps the platform from turning while you're working.

—Ken Prill, Chippewa Falls, Wis.


Stored position
9/16" hole to lock into working position
12" lazy-Susan bearing
Working position
1" access holes in platform to screw bearing to table

top shop tip



Continued on page 32

our winner

You might think a guy who designs and builds high-end custom furniture for a living learned his art at the side of a master craftsman. But Ken Prill learned it all by reading. "I'll bet I have 500 books and magazines on woodworking," our Top Shop Tip winner says.

Ken often adorns his work with hand-carved features. And business must be good because he has little time to pursue carving for pleasure, as with the elk relief he started three years ago (shown *above*). We're glad he took the time to send in the Top Shop Tip, at *left*, and we think you will be too.

For sending this issue's Top Shop Tip, we're sending Ken Prill an HTC Multi-Fence 50" tablesaw fence system. Attaboy, Ken!

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Circle No. 180

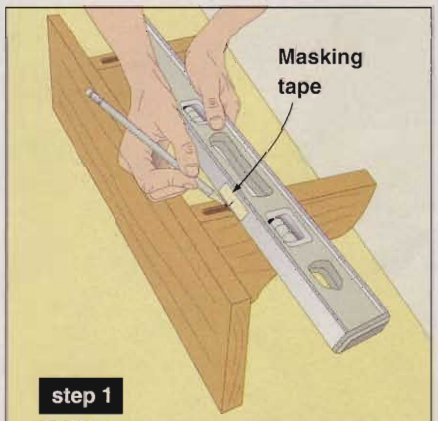
Foolproof hanging with keyhole slots

Keyhole slots are a great way to affix wooden hangings, such as a shelf or picture, to a wall. But if the mounting screws aren't perfectly level, or spaced exactly the same as the slots, the job can become a nightmare. Here's a solution that works great.

I attach short pieces of masking tape to the top of my level and, using the keyhole slots themselves, I mark the locations of the slots on the tape, as shown in Step 1. If I want to center the wall hanging between two objects, I also make a third mark, centered between the two marks.

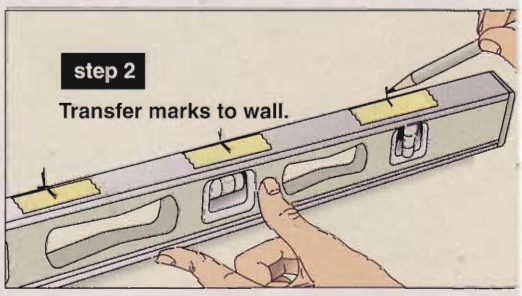
After finding the mounting location for the shelf, I mark the center of the shelf at the correct height. I place the level's center mark on that mark, make certain it's level, then mark the screw locations using the other two marks, as shown in Step 2. Finally, I drive the mounting screws on those marks. My hangings are always right on the money and level.

—Bill Vanderhoof, Hanover, Pa.



step 1

Mark centerline and keyhole-slot locations on masking tape affixed to level.



step 2

Transfer marks to wall.

Continued on page 34

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See Page 104

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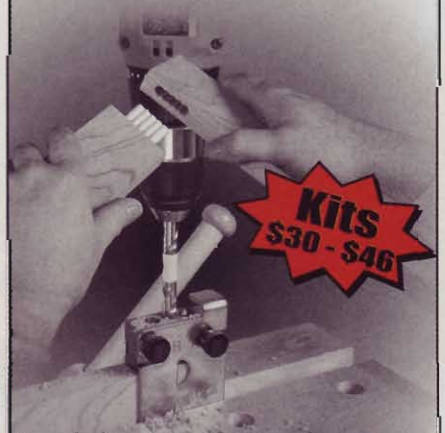

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Circle No. 800

shop tips

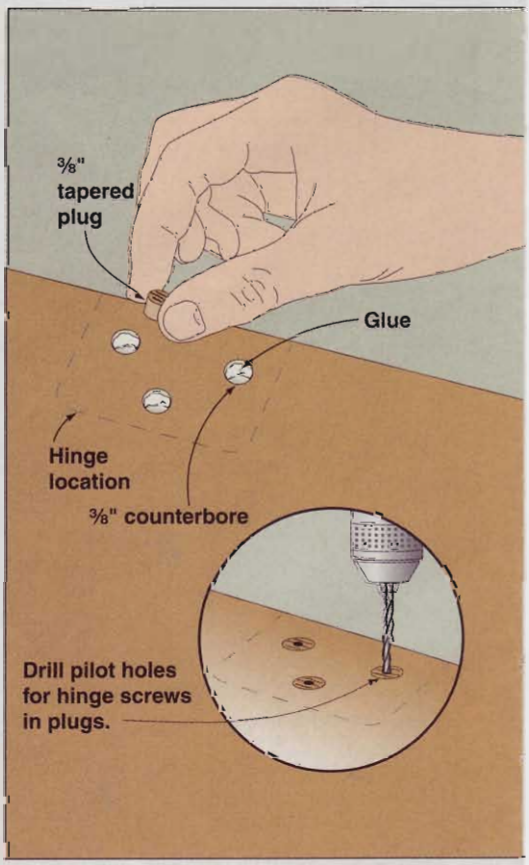
Pine plugs solve particleboard puzzler

I recently was faced with installing hinges on the lid of a toy box made of particleboard—a material notorious for not holding screws well. After puzzling over it for awhile, I finally decided to give the screws something more substantial to bite into.

After marking the hinge locations, I used a Forstner bit to bore ⅜" holes at each screw location, just deep enough to accept ⅜" flat-top, tapered, pine plugs at each location. (Plugs work better than dowels because, with dowels, you're screwing into end grain.)

I glued the plugs in place and tapped them flush, then immediately marked and drilled pilot holes for the screws, and installed the hinges. As I drove the screws, they spread the plugs just enough to form a tight bond with the particleboard. I expect these joints will outlast the toy box itself!

—Jon Murphy, Auburn, Wash., via WOOD ONLINE®



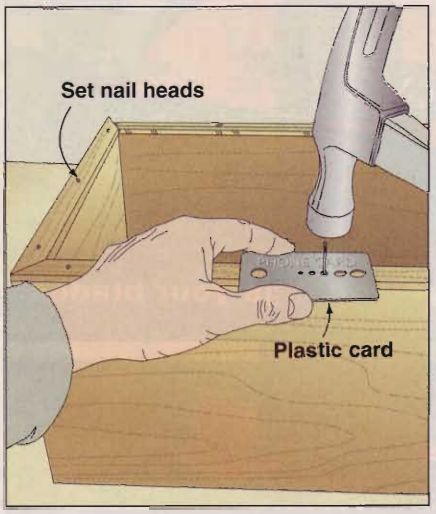
Card trick prevents hammer dents

Whenever I get an unsolicited plastic card in the mail, I save it, sometimes using it as a spreader for glue or spackling. But my favorite use is as a nailing shield to prevent hammer dents on wood surfaces.

Preparing a card for use is easy: Simply drill or punch holes larger than the finishing nails or brads you'll drive. After driving the fastener flush with the card, use a nail set to slightly bury the head.

A security note: Old phone cards and membership cards are good candidates for this application, but credit cards should be completely destroyed.

—Joe Carlino, Plainfield, Ill.

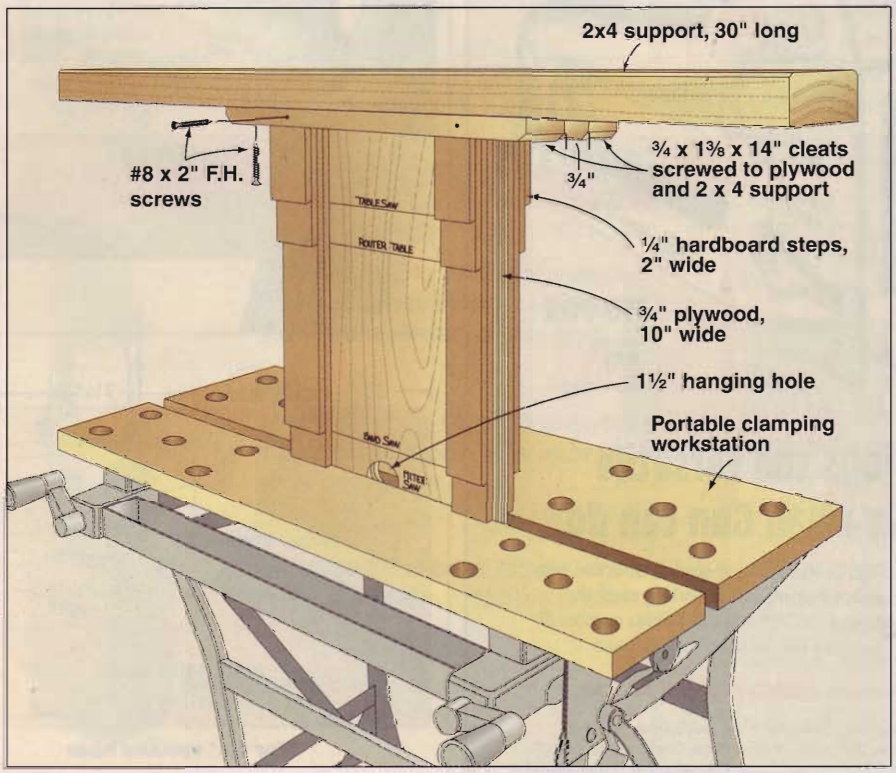


Fixture steps up to lend a hand

To support workpieces, I made a simple T-shaped fixture that secures to my portable clamping workstation. By adjusting the height of the fixture, I can use it with various tools, such as my tablesaw, radial-arm saw, router table, etc.

To instantly adjust to the proper height for each tool, I added hardboard "steps," as shown *below*. Each step sets the correct height for a different tool. Now when I need to support a long or wide workpiece, I simply clamp the fixture between the jaws of the workstation, resting it on the appropriate steps, and the height is spot-on every time.

—Al Finch, Baltimore, Md.



Continued on page 36

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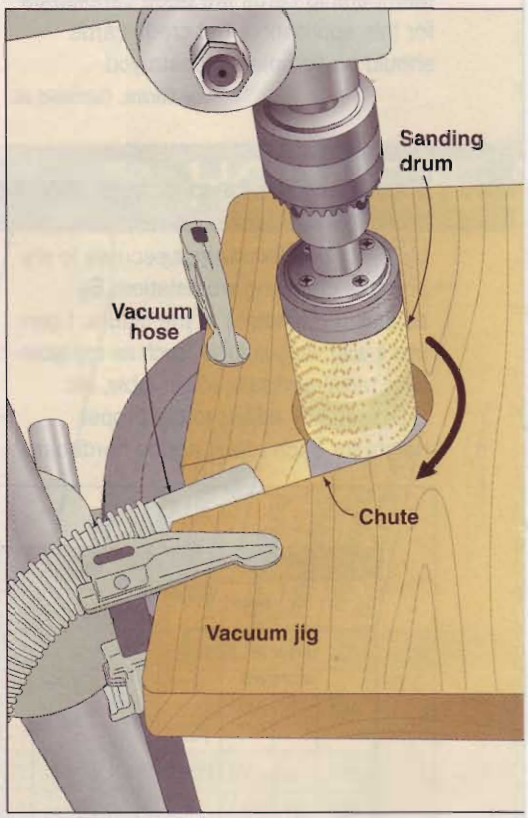
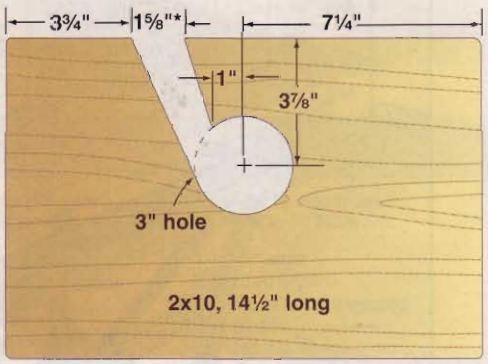
Chute sanding dust right into vac hose

Grab a scrap piece of 2×10 and make a drill-press accessory that helps make drum-sanding a less dusty operation. Use a holesaw to drill the centered 3" hole, and cut the chute with your bandsaw or jigsaw. Then, clamp the jig to your drill-press table. Air currents created by the spinning drum direct dust into the chute, and the vacuum system takes over from there.

—Ernest Peters, Brighton, Ontario





*For 1¼" vacuum hose

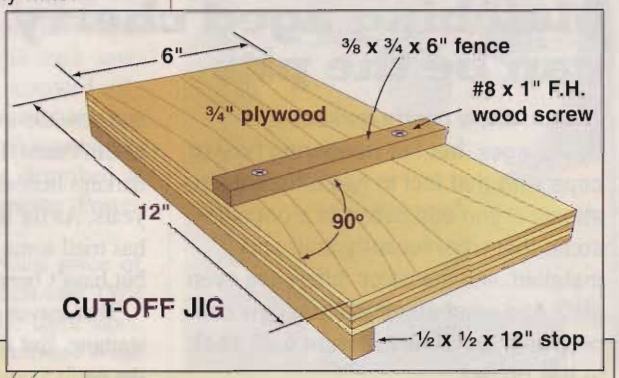
Lay it on the line for precise cutoffs

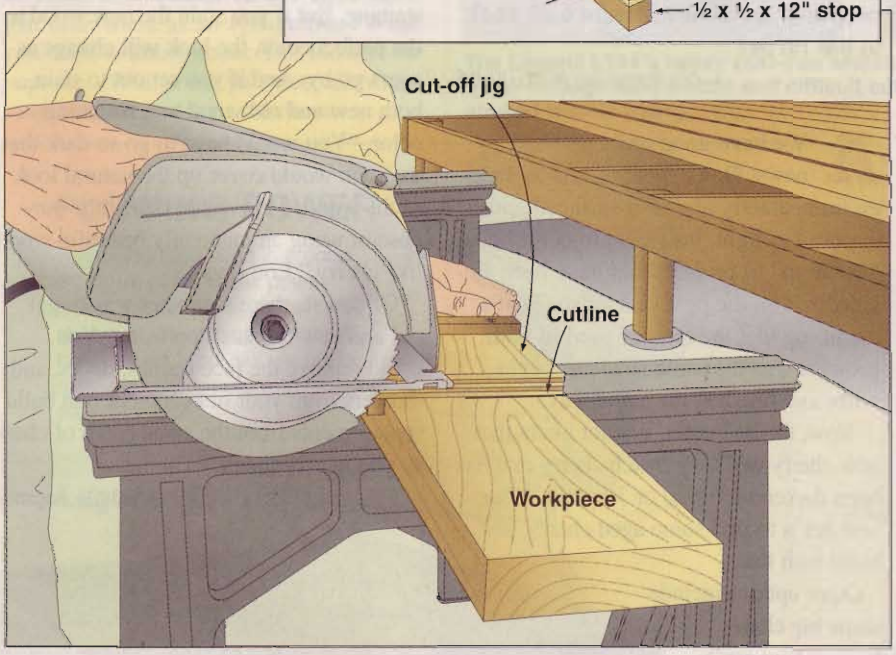
Take a few minutes to build this cut-off jig in your shop, and you'll take accuracy with you anywhere. The jig, shown in the *top* drawing, was designed for 6" deck boards, but you can easily scale the concept to any size—or any miter angle—you need.

After building the jig a little oversized, use your circular saw against the fence to trim the end of the jig to final length. The end now represents the cut that particular saw will make.

Simply mark the board where you want to cut it, position the stop against the edge of your workpiece, and align the end of the jig with the marked cutline. Push your saw across the jig, and you'll slice the board right on the money.

—Richard Rose, Durham, Maine





Post notes on project updates and hints

An issue or two after a project appears in a woodworking magazine, you'll sometimes read suggestions from readers who have built it. When I run across these items, I jot them on self-adhesive note paper and stick the notes on the first page of the original article. Or, if there's an accompanying drawing, I photocopy the magazine update and tape that to the original article. That way, if I build the project later, I'll have the benefit of others' experience right at hand.

—Mike Brenton, Chemainos, B.C., via WOOD ONLINE

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Answers to your questions from letters, e-mails, and WOOD ONLINE®

Matching aged cherry can be the pits

Q I know cherry darkens as it ages, but I'm wondering how to cope with that fact in two different situations: If you add cabinets alongside some that were recently built and installed, will the color difference even out? And what about placing new cabinets next to some that were built back in the 1970s?

—Don Borden, via WOOD ONLINE

A We have good news and bad news, Don. Cherry starts to darken immediately after it's surfaced and exposed to light, but new projects should "catch up" to projects that have been finished within the past year or so. That's assuming that the lumber used in both projects was the same shade to begin with, and finished the same way.

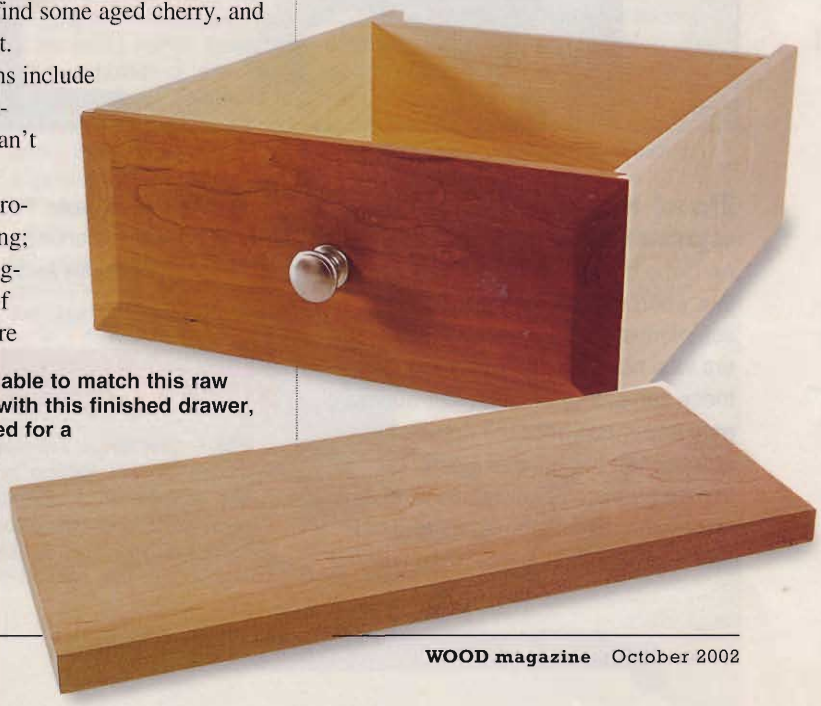
Now, the bad news. It's not likely that new cherry will ever match cherry that has been darkening for 20 or 30 years. Your best bet is to find some aged cherry, and build with that.

Other options include some big challenges. You can't lighten up the wood in old projects by sanding; Lou Irion, longtime builder of period furniture and now the owner of the Irion Lumber Co. in Pennsylvania, points out that cherry darkens beneath the surface over the years. As for darkening new boards, Lou has tried some chemical aging methods, but hasn't been satisifed with the results.

That leaves you with the possibility of staining. But if you stain the new wood to the perfect color, the look will change as years go by. And if you set out to stain both new and old wood to a matching color, "You would have to go so dark that the stain would cover up the natural look of the wood. That would defeat the purpose of using an inherently beautiful wood like cherry," Lou says.

Of course, there's another way to get old and new to match perfectly. You could remove the face frames, doors, and drawers from your old cabinets, and build replacements from the same batch of cherry you use for the new cabinets.

—WOOD® magazine



You might be able to match this raw cherry board with this finished drawer, which has aged for a year. But, the older the original piece, the harder it is to match it.

For the router that's lost its grip

Q I've been using my faithful router for over 20 years, but now the bits are starting to work loose. With the router mounted in a table, the bit gradually rises up and bites deeper into the wood as I work. Can this problem be fixed?

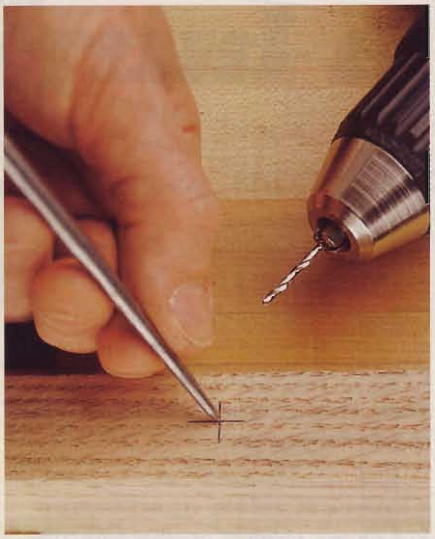
—James Peterson, Akron, Ohio

A Jim, you probably can solve it by replacing or cleaning the collet. To remove the collet for examination, turn the locknut as usual, but keep turning until it comes free of the router and releases the collet. Use a round brush with fine bristles made of brass or copper to clean dirt and rust from the inside of the collet, then spray on a light coat of WD-40 or other light oil to protect against future rusting. Wipe off any excess with a rag or paper towel.

Keep your router collets clean so that they'll keep a firm grip on your bits. We went to a gun shop to find a bristle brush that fits this ¼" collet.

Reinstall the collet and do some routing. If the slippage continues, you might need a new collet. Check with your dealer or call Tools On Sale, a division of Seven Corners Hardware, at 800/328-0457. They carry collets for most brands and models. A final tip: Get in the habit of removing the bit after completing each router operation. That helps to keep the collet flexible.

—WOOD® magazine



The variation in oak grain really encourages a small drill bit to wander off course. Mark the spot with a sharp awl, and insert the bit deep into the chuck.

Taming a bit that's born to wander

Q I need to drill several 3/32" holes in the edge of a disc, but can't keep the drill bit from wandering. I know a brad-point bit would help, but I don't know if they make one that small. Any other ideas?

—Steve, via WOOD ONLINE®

A Woodworker's Supply carries a 3/32" brad-point bit with a hex shank, Steve. Call 800/645-9292 and order item number 824-192 for $7.99. They also have ⅛" and 1/16" brad-points. In most cases, however, you should be able to keep almost any drill bit where you want it by marking the hole location with a sharp awl before you drill. When using a straight-shank bit, place it deep into the chuck to keep it from wobbling.

*—*WOOD *magazine*

Got a question?

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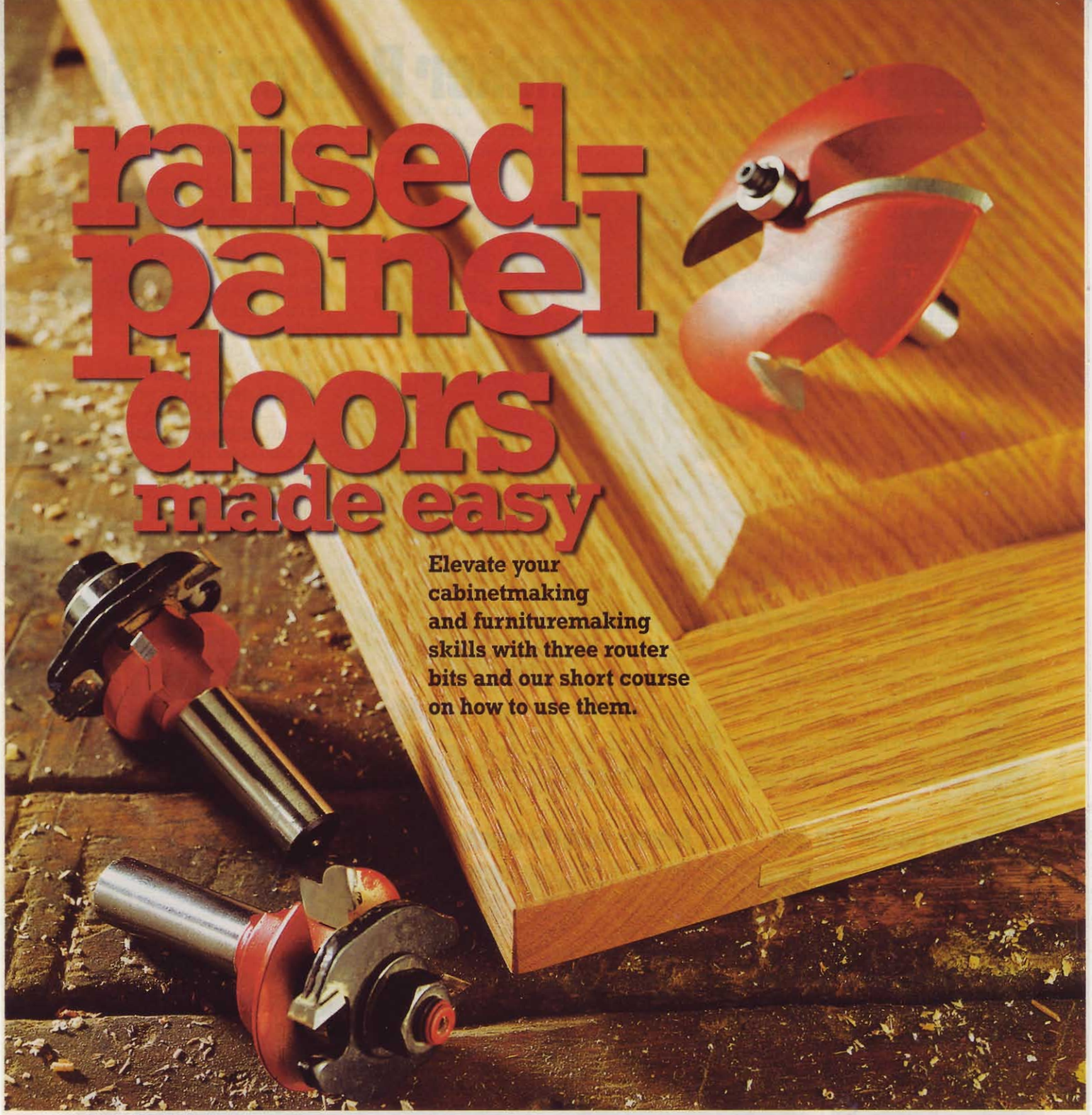


Elevate your cabinetmaking and furnituremaking skills with three router bits and our short course on how to use them.

Raised-panel doors are a hallmark of quality cabinets and furniture, and they're not difficult to make. If you have a variable-speed, 1½-hp or bigger router and a router table, you need only buy a set of three router bits designed for the task.

The bits could cost well over $100. Still, if you plan to make or remodel several cabinets, or construct a special piece of furniture featuring raised-panel doors, we think they're worth the investment. Of course, you could choose to cut raised panels on the tablesaw instead, but we've found that router bits save lots of time and add quality with their smooth cutting and well-designed profiles.

We used a horizontal panel-raising bit that cuts with the workpiece lying flat on the router table. You also can buy vertical router bits, which cost less and demand less power. However, they don't allow you to raise a panel with a curved edge, as the horizontal cutter does.

In this article, we'll guide you through the process of making a door for a typical cabinet. The same techniques apply to building a door or panel for a piece of furniture, or traditional wall panels. Along the way, we'll point out a few details that have nothing to do with router bits, but everything to do with getting the most striking results.

Two bits for the door frame ...

A set of door-making router bits makes it easy to build professional-quality cabinet doors. One bit cuts the coped shape at the ends of the rails; one cuts the sticking shape to match; and one cuts a raised field on the panel.

... and a third for the panel

This large-diameter bit cuts the cove profile that "raises" the panel.

Choose a cool profile

We chose a rail, stile, and panel set from Freud, item number 97-102. You can buy it from www.toolcrib.amazon.com for $144.99, and from other sources as well. This set contains a coping bit to cut the ends of the rails, a sticking bit to cut a matching profile and panel-holding groove on the inside edge of each rail and stile, and a 3½"-diameter bit that "raises" the panel with a gently sweeping cove. The bits have ½" shanks, which we strongly recommend for this operation.

See **Photos A**, **B**, and **C** for the shapes made by our rail-and-stile cutters, and how the results mate together. **Photo D** shows one of the many panel-raising bit profiles available from Freud and other manufacturers. Choose the one you like best, or the one that matches the style of your home's existing cabinetry.

Select the best stock

A great door depends on great lumber. You want wood that shrinks and swells as little as possible, and resists warping. Rift-sawn or quartersawn lumber fills the bill.

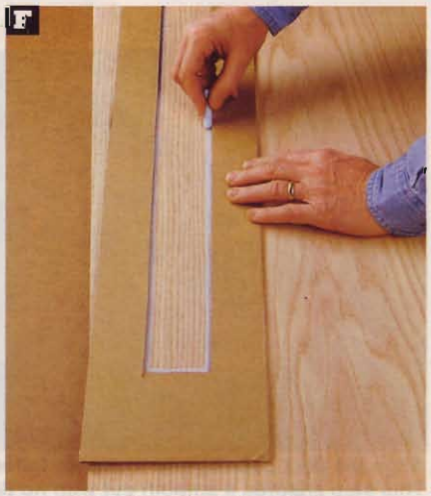
Go through the stack of boards at your lumber supplier, and look at the end grain on each one. Select the ones with grain lines running straight from face to face, not from edge to edge or in a semi-circle. These prime boards also feature straight face grain, which played an important role in our door, as you'll see.

You might find quite a bit of variation in one wide board, as shown in **Photo E**. In that case, elevate your work above the ordinary by selecting the straight grain lines for your doors. The cathedral grain won't go to waste; use it for less visible cabinet parts or other projects.

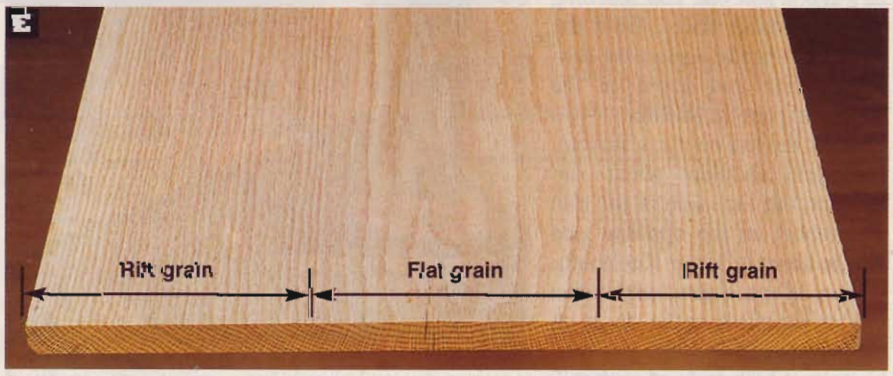
Once you've found a good board, don't just chop it into convenient lengths. Take one more big step toward master craftsmanship by cutting each individual piece with the straightest grain possible, as shown in **Photo F**.

Straight-grain rails and stiles seem to flow naturally around a door. We recommend straight grain for the panels, too. It lends an architectural-quality look.

We used red oak for this article because it's a popular cabinet choice and its prominent grain lines emphasize the difference in appearance between straight grain and random "cathedral" grain. Check out the two versions in **Photo G**. When you go to a retail outlet to look at oak cabinets, you see lots of figure, and maybe you prefer it that way. The choice is yours.



In a piece of cardboard, cut out a "window" the same size as the part you need to make. When you see the grain you want, mark the outline with chalk.



Here you see rift grain and flat grain within one 18" board. Plan to use the rift grain for visible parts and the flat grain elsewhere.

Two variations on red oak: The panel on the left was made with well-matched straight grain; the one on the right offers a more common appearance.

Plan and cut carefully

We built an overlay door for a standard-sized wall cabinet, a common situation. We planed 4/4 stock to ¾" for our rails and stiles, and ripped them to 2¼" in width, a dimension that looks good, feels solid, and allows enough room for any style of hinge. You might choose a width anywhere from 1½" to 2½". Pick stock that's perfectly flat for the rails and stiles.

The door itself should fall between 9" and 18" in width. Too narrow, and it just won't look right. If you build it wider than 18", you're more likely to have trouble with twisting. The door must be absolutely flat to look good when it's closed.

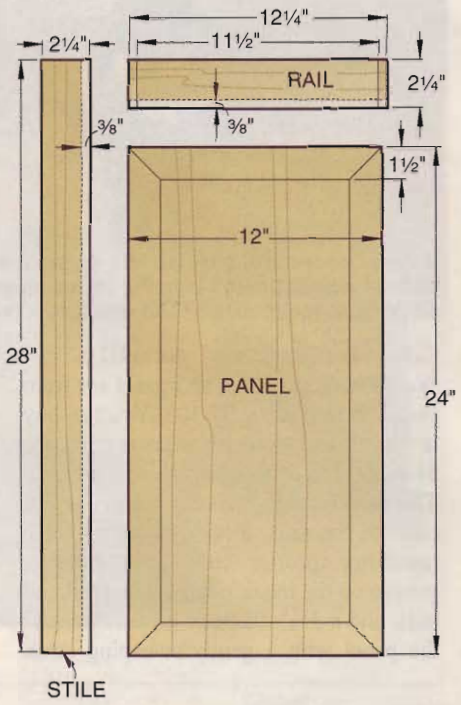
An overlay door is typically used on cabinets without face frames. Size each door to nearly cover the cabinet box, and plan for a ⅛" gap between adjoining doors.

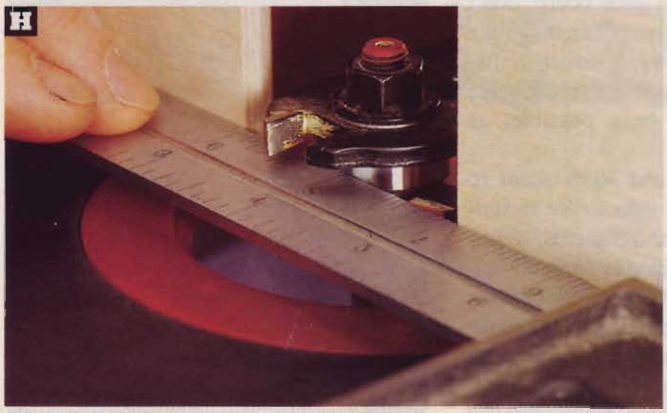
The sample door in **Drawing 1** will help you keep track of the slots and coped rail ends as you figure the dimensions of your door. Check your crosscutting setup for accuracy before you cut the pieces to length, because the rails must be perfectly square for good results. Prevent chip-out with an auxiliary fence on your miter gauge, or a sacrificial piece of straight stock on the back fence of your crosscut sled. Cut an extra rail and an extra stile to use when setting bit heights.

To make the panel, choose boards with compatible color and figure, and plane them to a thickness of ½". Once you fit the panel into place, its surface will sit flush with the front of the frame.

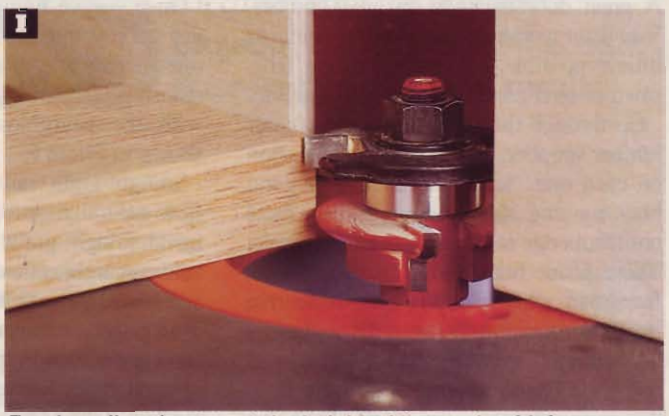
Joint the edges of the boards, then glue and clamp them together to make a slightly oversize blank. After the glue dries, cut the panel to allow for a ⅛" gap all around as it sits in the grooves of the rails and stiles. This gap accommodates the spacers described in "No-rattle panels," *page 47, bottom*. If you choose not to use spacers, you still must leave the same gap to allow for wood movement.

1 TYPICAL DIMENSIONS





H Align the pilot bearing and the fence before beginning to rout. This step ensures a smooth cut with no dips.



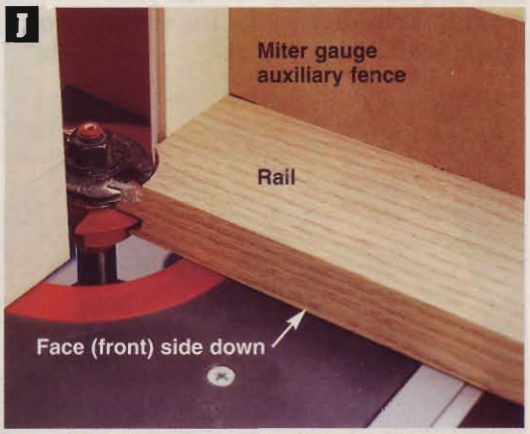
I For the rail-end cuts, set the height of the coping bit by eye. Place the top of its slotting cutter just proud of the workpiece.

Rout the rail ends

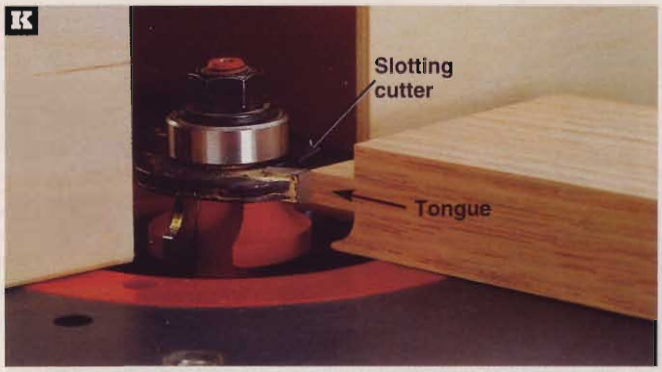
With your router mounted in a table, install the coping bit. It's the bit with a pilot bearing sandwiched between the two cutters. Hold a straightedge against the router table fence, and slide the fence until the straightedge contacts the pilot bearing, as shown in **Photo H**. Now make sure the fence sits at a right angle to the miter gauge; butt a piece of scrap against the fence at one end, clamp it to your miter gauge, then slide the miter gauge along the fence. The scrap should maintain contact all along the length of the fence.

Use your test rail to set the height of the bit, as shown in **Photo I**. Place your test rail face side down on the table, one edge flat against the miter gauge auxiliary fence and one end touching the router-table fence. Hold the workpiece firmly against the auxiliary fence and down on the table, and rout the profile.

Check the test cut for a smooth, consistent shoulder about 1/16" thick on the face side of the rail. The rabbet on the opposite side will be about ¼" deep. Run another test, if necessary, and when you're satisfied, make a set-up piece to keep for future projects. Now, rout both ends of each rail, as shown in **Photo J**.

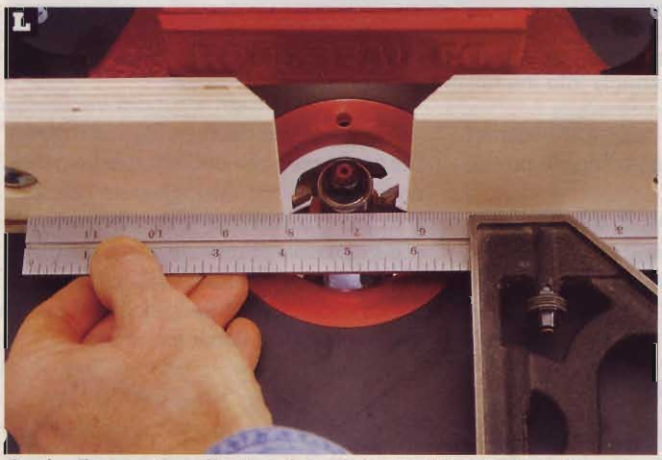


J Keep the rail square to the router-table fence with your miter gauge and auxiliary fence. The auxiliary fence also prevents chip-out.



Use the coped end of a rail to set up the sticking cuts. Match the slotting cutter to the tongue, and if the curved profiles don't mate, re-shim the bit.

Make the long-grain cuts on all four frame pieces. Your fingers are close to the bit, so be sure to keep your right hand at the outside corner as you push.



Again, line up the pilot bearing of the sticking bit and the router table fence to ensure accuracy.

Now, the inside edges

Remove the coping bit and install the sticking bit (the one with the pilot bearing on top) in your router. In one pass, this bit makes the frame look better by rounding over the edge next to the panel, while simultaneously cutting the groove to receive the panel. Use one of the rails that you just routed to set the height. Match the slot-cutter with the tongue on the rail end, as shown in **Photo K**. Again, align the fence and pilot bearing with a straightedge, as shown in **Photo L**.

Place your extra stile face side down against the router table fence, and make a test cut, as shown in **Photo M**. Check its fit with the already routed rail. Place both pieces flat on your workbench or tablesaw top, face sides up, and check the resulting joint with your fingertips. You want a perfectly smooth joint, because anything less means a lot of sanding after assembly. So do as many tests as it takes to get it right, and then cut a set-up piece for future reference. See the Shop Tip *below* for another way to save your settings.

If you can't get a perfect fit with the rails and stiles, you may have to adjust the bits themselves with very thin, washer-like, metal shims. Shims allow you to fine-tune the height of the profile cutters or the location of the tongue on the rail-end bit. Our bits came pre-shimmed from the factory, with extra shims held under the nut at the end of each bit. Write down each step if you do any shimming, so you know the original arrangement as well as each adjustment that you make. When your test joints are right, rout the inside edge of all four frame pieces.

SHOP TIP

Make your bits self-aligning

Wouldn't it be nice to keep your rail-and-stile profile cutters permanently aligned with one another, avoiding all those test cuts every time you use them? Our master craftsman, Chuck Hedlund, came up with a way to do just that.

Slip a ½" stop collar onto the shank of each bit, and tighten it in place against the cutter body, as shown in the photo at *right*. Install the first bit into your router, and proceed to find the right height. Unplug the router, loosen the set screw on the collar, let it slide down to the collet, and retighten the set screw. Without changing the router height, do the same with the second cutter. The next time you use the cutters, use a saved set-up profile to set the router height for the first cutter, and the second cutter will match automatically.

Look for stop collars at your home center or hardware store, or buy a seven-piece set that includes one ½" collar from Woodcraft. Call 800/225-1153 to order item number 142562 for $7.99.

For safety, Freud recommends that you place at least 80 percent of a router bit's shank inside the collet. We achieved that with collars that are 5/16" thick.

Time to raise the panel

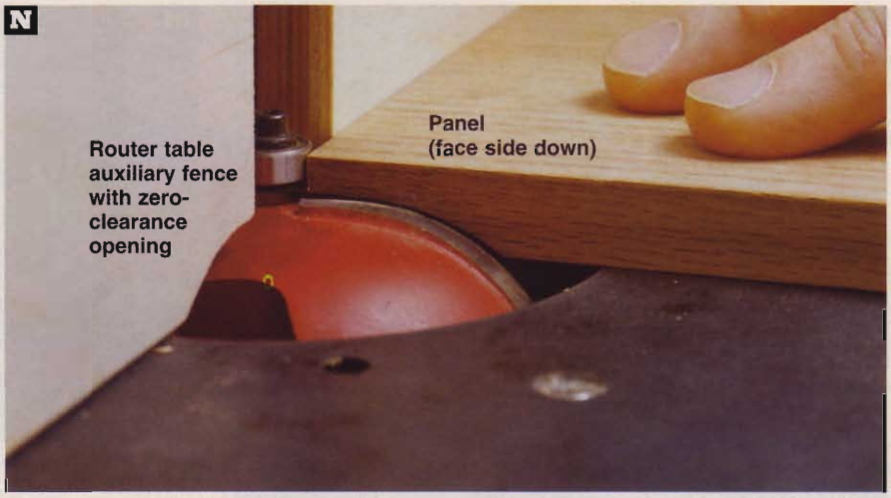
For the final step in the milling process, we used a panel-raising bit that measures 3½" in diameter. The large diameter means that it cuts more wood per revolution than the average bit, its outer edge travels faster than most, and it demands extra clearance in the table and fence.

For safety and efficiency, use a variable-speed router with at least 1½ hp. That's enough power to do the job, and running it at a low speed makes the operation safer.

Even if you have a split fence that opens wide enough to accommodate the bit, it's safer to shape a smaller opening in an auxiliary fence. A wide gap causes problems if the workpiece slips into it.

To add an auxiliary wood fence, cut a piece of straight wood to size, and mark the shape of the bit on it. Cut the opening on the bandsaw, and smooth it with sandpaper. Attach the auxiliary fence to the existing fence, and check the bit clearance.

Align the bearing and fence, and make a test cut, as shown in **Photo N**. If the router bogs down, adjust the fence so that the bit cuts less than the full width of the profile on the first pass. Then realign the bearing and fence, and shape the complete profile in another pass.



Remember that the test pieces for this cut must be the same thickness as the panel. The tongue should fit snugly into the rail and stile grooves.

Test the fit of the panel tongue in the groove of a rail or stile. It should slide in easily. If you have to force it into the groove, raise the bit. If it rattles inside the groove, lower the bit.

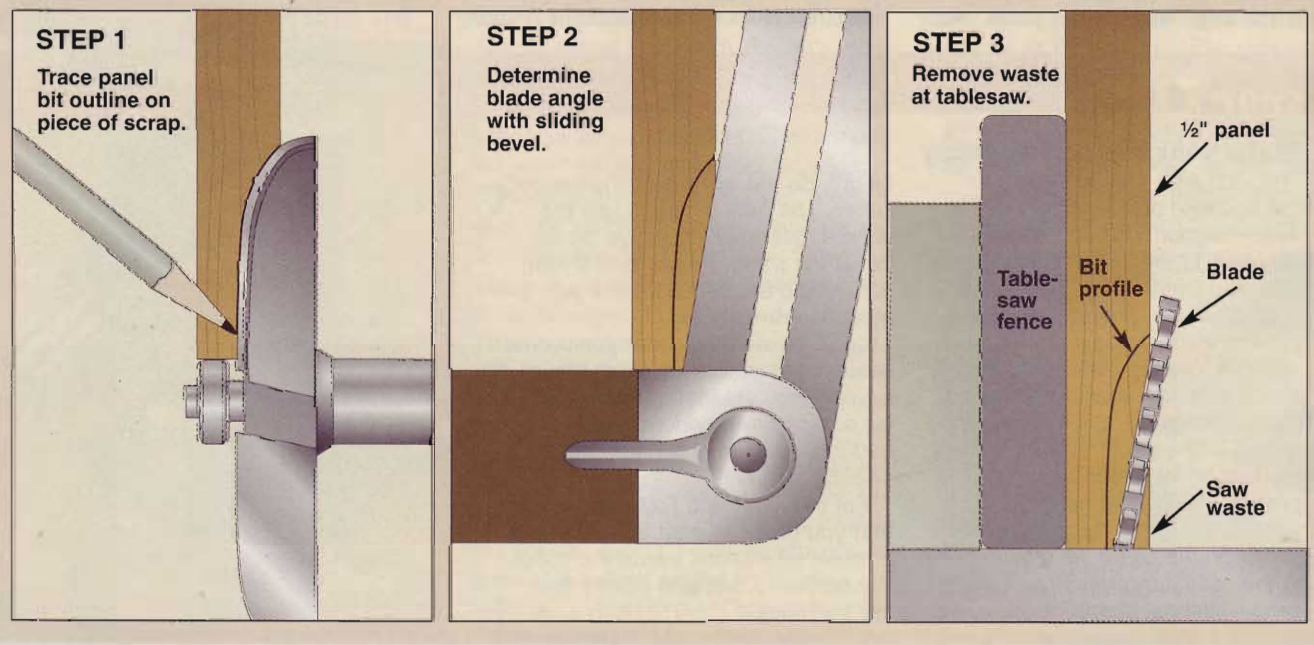
When you find the right fit, rout the profile on the panel. Rout both ends first, then do the long sides; the long-grain cuts will shave off any minor chip-out from the end-grain cuts. Press downward on the workpiece as you rout, making sure that the shoulder around the panel field maintains a consistent depth.

SHOP TIP

Give your router a break as you raise a panel

Here's how reader Robert Reed of Roaming Shores, Ohio, minimizes the amount of wood removed by his panel-raising bit. Take a piece of scrapwood, and trace the profile of your panel-raising bit on it. Use a sliding bevel gauge to find an angle that cuts away most of the waste, without touching the desired profile. Set up your tablesaw with the sliding bevel, and run each side and end of the panel through as shown. Now you have much less wood to rout.

Note that you'll set the rip fence away from the tilt of the blade. You can add a tall fence to the rip fence to support the workpiece while you machine it on edge.



Stain the panel

With the door parts milled, you're ready to prepare for assembly. You allowed for wood movement in the solid panel, during the planning phase. Carry through by installing spacers, as described in "No-rattle panels," *below*, and by staining the panel, as in **Photo O**, if stain is part of your finishing plan. Stain the back first, then place it on a support while you stain the face.

By staining the panel before assembly, you ensure that the stain completely coats the tongue of the panel. If you waited until after assembly, areas of the tongue might remain unstained, and could become visible when the panel shrinks in dry weather.

Don't stain the rails and stiles just yet. If stain got onto the gluing surfaces, it could prevent the glue from adhering properly.

After the stain on the panel dries, insert the spacers, and apply yellow glue to all of the surfaces that you milled on the rail end. Use only a light coating near the inside edge to keep squeeze-out away from the panel; even a weak bond there could cause problems.

Assemble the door, and place it on two bar or pipe clamps, located to apply pressure across the width of the door at each end, as shown in **Photo P**. Measure diagonally between both pairs of opposing corners, also shown in the photo, to make sure the door is square. The two measurements should be equal. If not, loosen the clamps, slightly angle them to pull the frame into alignment, and retighten. Let the glue dry before staining the frame.

If you plan to stain your cabinet door, do the panel before assembly. The clear topcoat can wait until after assembly.

When you cut the rail ends square, and accurately match the coped and sticked profiles, assembly becomes almost automatic.

Written by **Jim Pollock** with **Charles I. Hedlund**
Photographs: **Marty Baldwin**
Illustrations: **Roxanne LeMoine; Tim Cahill**

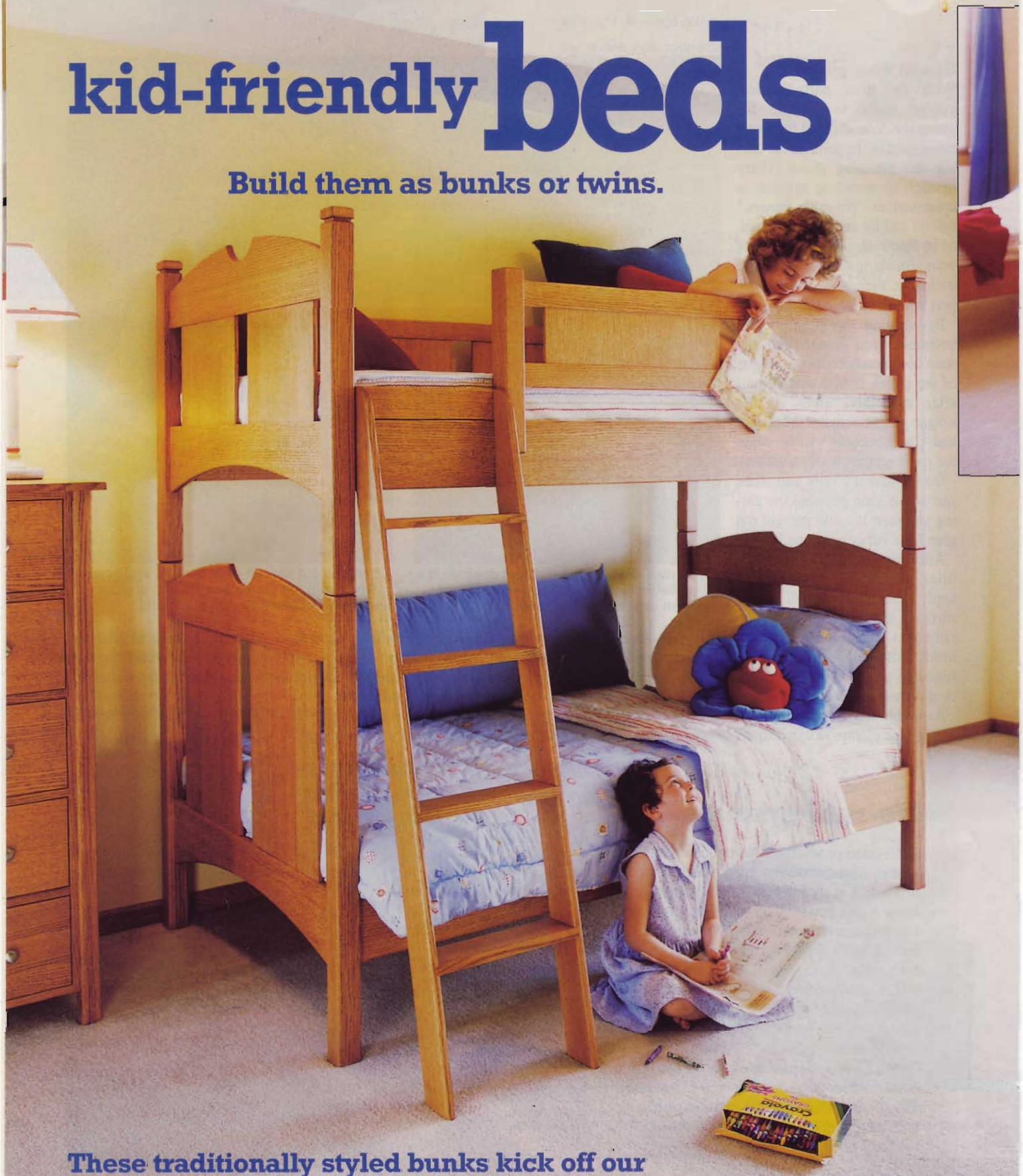
No-rattle panels

Solid-wood panels must have room to move, as they absorb moisture in humid weather, and lose it in dry times. But if you simply leave a gap, you wind up with a door that rattles and sounds poorly made. You can use various kinds of plastic foam to fill that gap, but we like "Space Balls." These firm rubber spheres, about ¼" in diameter, do the job quickly and neatly. Woodcraft sells a package of 100 for $4.99; call 800/225-1153 to order item number 142284. Use two Space Balls on each side and each end of a small door, or three per side on a bigger one. They'll compress when the panel expands, and return to full size as the panel shrinks, holding it tightly in its grooves all the while.

Push the Space Balls into the grooves as far as you can with your finger. The panel will seat them during assembly.

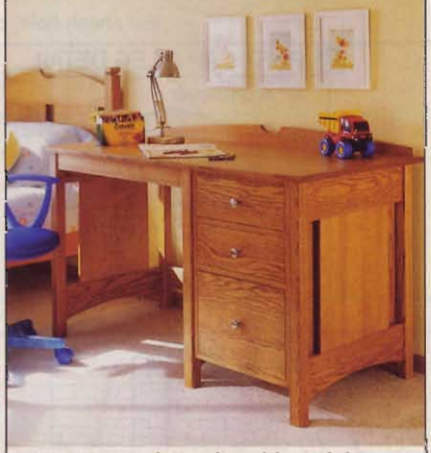
kid-friendly beds

Build them as bunks or twins.



These traditionally styled bunks kick off our latest children's bedroom set.

Don't miss the matching dresser and desk.



Immediately following this article you'll find complete plans for a dresser that shares the style and straightforward construction methods used in the beds. Find complete plans for the matching desk shown *above* in the next issue.

Children will enjoy sweet slumber for years to come with this versatile design. In this article, you'll learn how to make a single bed—to build bunk beds, just make two of these beds, stack them one atop another with bed-joining dowels, and add the ladder and guardrails as described. If the kids grow out of bunk beds at some point, simply slip out the unglued dowels and, voilà, you have a pair of twin beds.

Note: This bed design accommodates a 39×75" twin mattress. You'll need to adjust bed dimensions accordingly for a different-size mattress. If you make other modifications, be sure to see the article about designing safe bunk beds on page 24.

For the items needed to build this project, see the Cutting Diagram and Materials List on *page 55.*

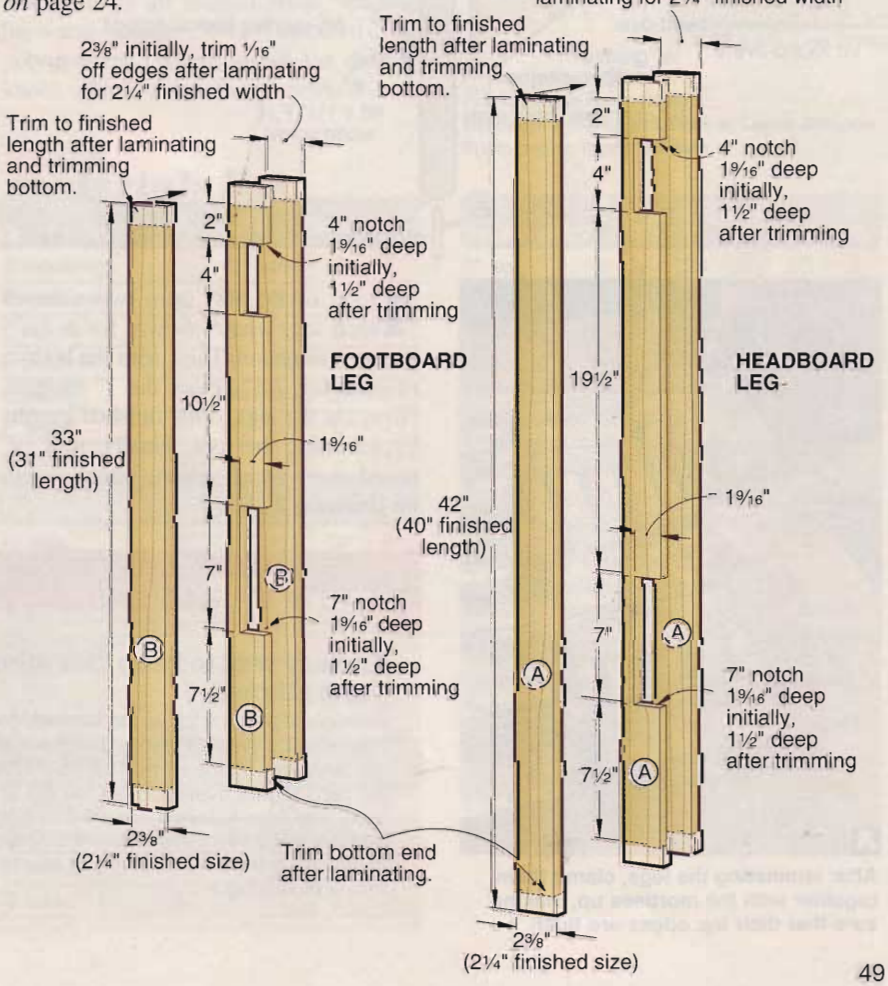
Start with the legs

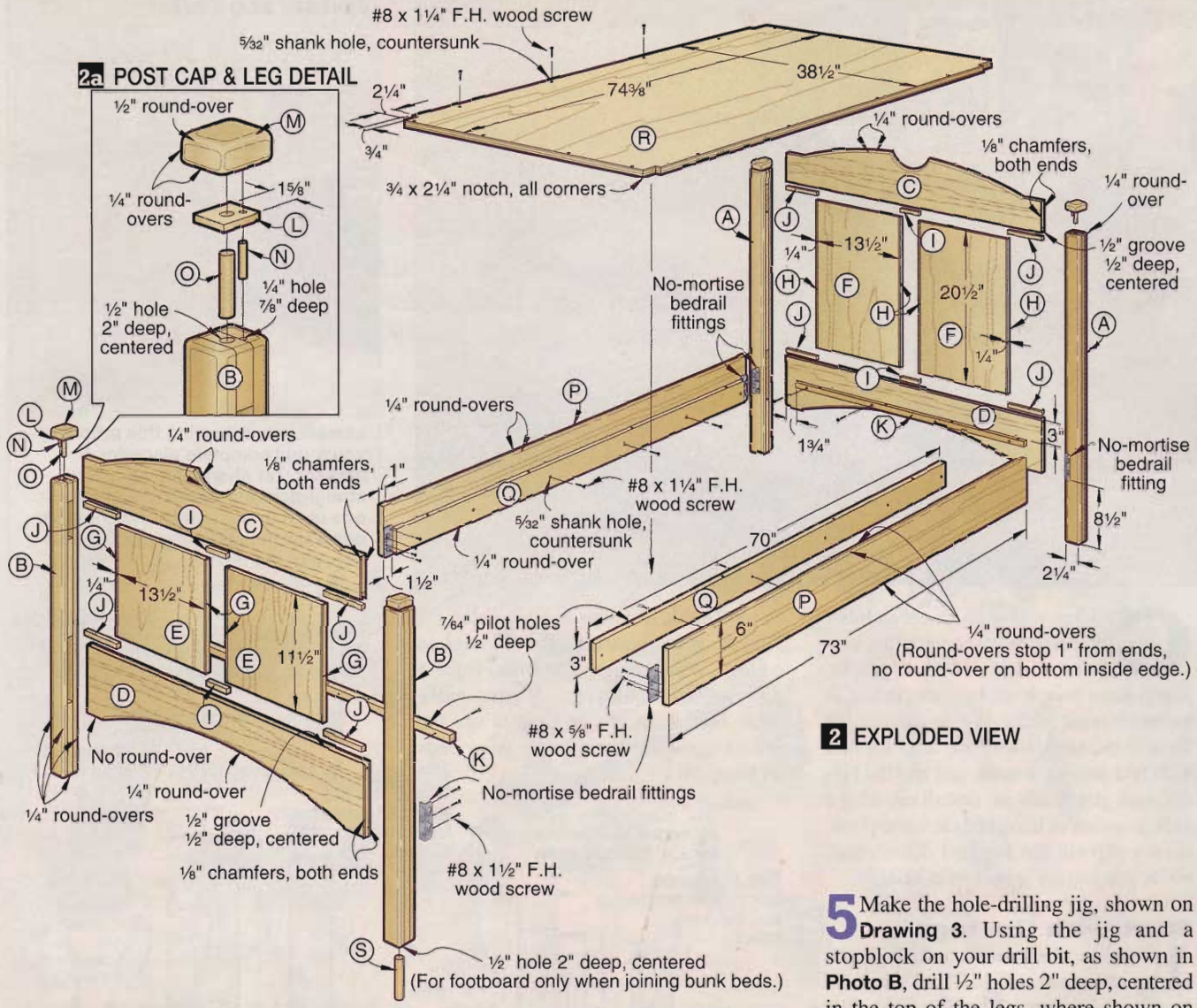
1 From ¾"-thick stock, cut six headboard leg parts (A) to 2⅜×42" and six footboard leg parts (B) to 2⅜×33". The legs are initially oversized ⅛" in width and 2" in length. The edges are jointed or ripped and the ends are trimmed after the legs are laminated, where shown on **Drawing 1**.

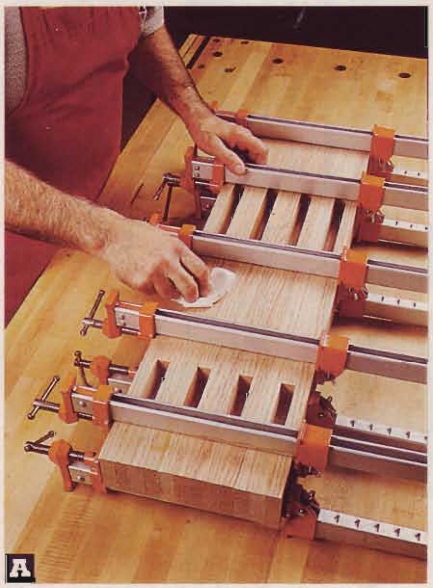
2 Cut the notches in two leg parts (A) and two leg parts (B), where dimensioned, using a bandsaw or a tablesaw fitted with a ¾" dado blade. The notches form mortises in the finished laminated legs.

3 To assemble the legs, first refer to the **Shop Tip,** *page 50, bottom right.* Then, apply glue and assemble the legs (A, B) in the configuration shown on **Drawing 1**, keeping the ends and edges flush. (We used white glue, which has a longer working time, to assemble the legs.) Clamp the legs together, as shown in **Photo A**. Remove excess glue from the edges and inside the mortises.

1 LEG ASSEMBLIES


2⅜" initially, trim 1/16" off edges after laminating for 2¼" finished width
Trim to finished length after laminating and trimming bottom.
2⅜" initially, trim 1/16" off edges after laminating for 2¼" finished width
Trim to finished length after laminating and trimming bottom.
2"
4"
4" notch 1⁹⁄₁₆" deep initially, 1½" deep after trimming
FOOTBOARD LEG
10½"
33" (31" finished length)
1⁹⁄₁₆"
7"
7" notch 1⁹⁄₁₆" deep initially, 1½" deep after trimming
7½"
2⅜" (2¼" finished size)
Trim bottom end after laminating.
2"
4"
4" notch 1⁹⁄₁₆" deep initially, 1½" deep after trimming
HEADBOARD LEG
19½"
42" (40" finished length)
1⁹⁄₁₆"
7"
7" notch 1⁹⁄₁₆" deep initially, 1½" deep after trimming
7½"
2⅜" (2¼" finished size)





After laminating the legs, clamp them together with the mortises up, making sure that their top edges are flush.

4 Joint or rip 1⁄16" from two sides of each leg, where shown, for a 2¼"-square lamination. Then, trim the bottom of each leg 7½" below the 7" mortise. Now, cut the legs to the finished lengths by trimming the tops. Finally, rout ¼" round-overs on all edges, where shown on **Drawing 2**.

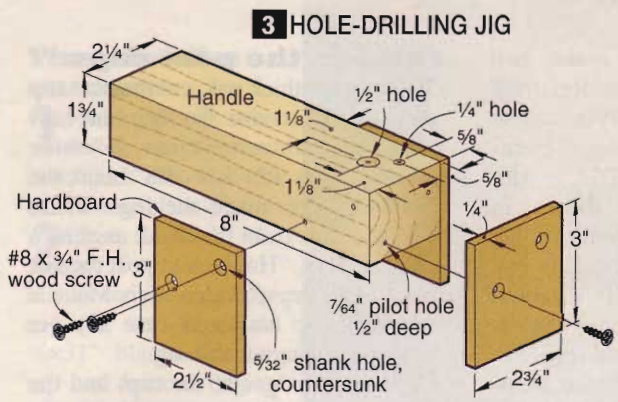
5 Make the hole-drilling jig, shown on **Drawing 3**. Using the jig and a stopblock on your drill bit, as shown in **Photo B**, drill ½" holes 2" deep, centered in the top of the legs, where shown on **Drawing 2a,** to receive the post-cap dowels (O). Also, drill a ¼" hole ⅞" deep to receive the post-cap alignment pin (N).

Note: *For bunk beds, position the jig on the bottom of the legs and drill ½" holes 2" deep to receive the bed-joining dowels (S), where shown on* **Drawing 2**.

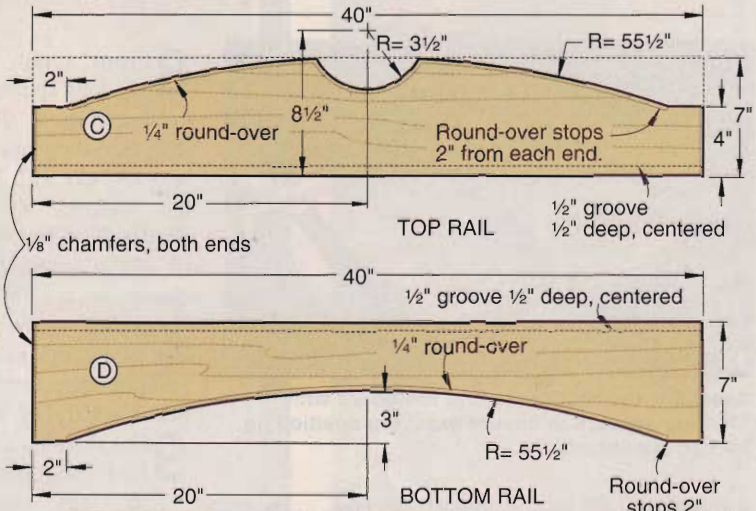
SHOP TIP

An easy way to keep face-glued parts aligned

Face-glued parts, such as the laminated legs in this project, have a tendency to slip out of position when you clamp them. To prevent this, cut the parts slightly oversized (as you did for the legs), and drive a couple of nails through the waste area as you assemble them. Keep the nails away from the cutline so you won't hit them with your saw blade.



3 HOLE-DRILLING JIG



4 HEADBOARD AND FOOTBOARD RAILS

Next up: the headboard and footboard

1 Cut the top rails (C) and bottom rails (D) for the headboard and footboard to the size listed in the Materials List. Then, cut a ½" groove ½" deep, centered in the rails, to receive the footboard panel assemblies (E/G) and headboard panel assemblies (F/H), where shown on **Drawing 2**. To ease insertion of the rails into the legs and provide room for glue squeeze-out, rout ⅛" chamfers on the ends of the rails, where shown.

Position the hole-drilling jig with the handle opposite the mortised side of the leg. Use the holes in the handle as guides for drilling.

2 Lay out the arch on the top rails, where shown on **Drawing 4**. To do this, first clamp two ¾×1×2" stopblocks to a rail, one at each end of the intended arch, with the stopblocks' bottoms positioned 4" from the bottom of the rail and their inside edges positioned 2" from the ends. Rip a ⅛"-thick wood fairing strip 42" long. Place the strip against the stopblocks, and flex it so its bottom is flush with the top edge of the rail at its center. Mark the arch. Then, using a compass, mark the 3½" radius at the top of the rail, where dimensioned.

3 Bandsaw the top of the rail to shape. Use a fence for the 2" straight cuts into the ends of the rail to ensure the tenons make a good fit in the legs. Sand the cut edges smooth. Then, use this rail as a template to mark the contour on the other top rail. Now, cut and sand it to shape.

4 Using the same process as for the top rails, lay out the arch on the bottom rails, where shown. Cut and sand to shape.

5 Rout the ¼" stopped round-overs on the top and bottom rails, where shown on **Drawings 2** and **4**. For an easy way to do this, first refer to the **Shop Tip**, *below*, to make a round-over stopblock jig. Then, with the applicable stopblock positioned on an end of a rail, as shown, ease the ¼" round-over bit into an edge at the center of a rail and rout to the stopblock. Repeat on the opposite edge. Reposition the stopblock at the other end of the rail and repeat the process to complete the round-overs.

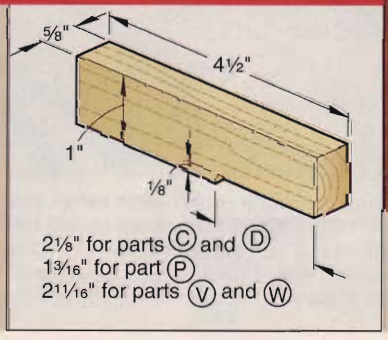
6 From ½" oak plywood, cut the footboard panels (E) and the headboard panels (F) to size. From ¼"-thick oak, rip four ⅝×11½" blanks for the footboard edging (G) and four ⅝×20½" blanks for the headboard edging (H). Glue the edging to the panels with a 1/16" overhang on each face. After the glue dries, trim the edging flush to the panels. (For an easy way to do this, make the flush-trimming fence, shown on *page 10*.)

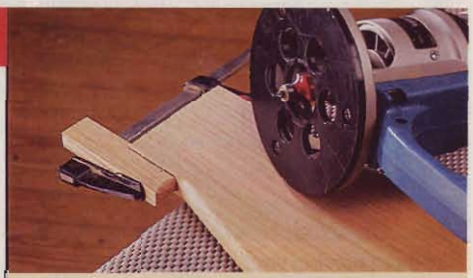
7 Cut four spacers (I) and eight spacers (J) to size. Mark the center of the spacers (I) across the grain on one of their faces. Also, mark a centerline across the grain on one face of each rail. Now, glue

SHOP TIP

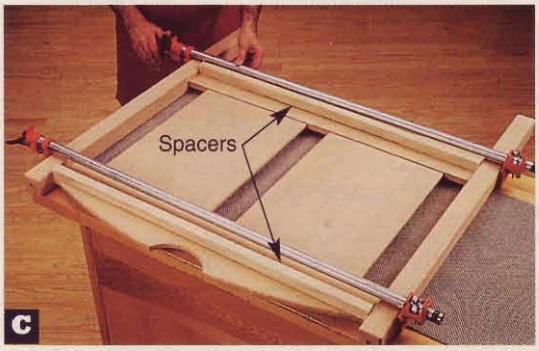
A simple jig for forming stopped round-overs

We made the handy jigs, *shown right*, to form the stopped round-overs for this project. To use one jig, clamp it to the end of a board, as shown *far right*. When routing, your bit's pilot bearing will contact the jig, stopping the round-over at the desired location. Note that the notch dimensions differ slightly from those shown on **Drawings 2**, **4** and **7** for stopping the round-overs. This is to compensate for the difference between the pilot bearing and bit diameters and the curved surfaces on parts C and D.





Clamp the applicable round-over stopblock with the notch tight against the end of the board. Make sure the clamp will not interfere with the router.



Assemble the headboard and footboard with 37"-long spacers to ensure exact leg positioning for bed alignment.

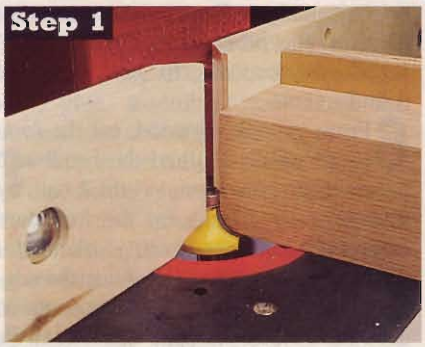
a spacer into the groove in each top and bottom rail with the centerlines aligned, and clamp.

Note: *For bunk beds, make four additional spacers (I) and eight additional spacers (J), and set aside for assembling the guardrails later.*

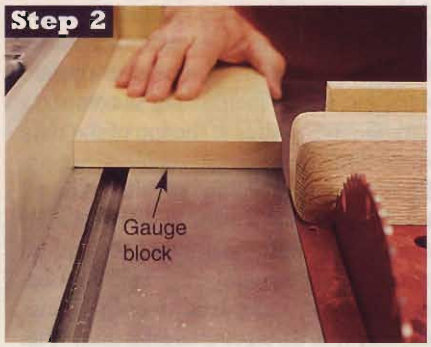
8 From scrap, make two 37"-long spacers. Referring to **Drawing 2**, dry-assemble (no glue) the headboard members (A, C/I, D/I, F/H, J) with the spacers, as shown in **Photo C**. After verifying the fit of the assembly, glue and clamp the members together, checking for square. Following the same process, assemble the footboard members (B, C/I, D/I, E/G, J).

9 Cut the cleats (K) to size. Drill countersunk shank holes in each cleat, where shown. Position a cleat on the inside face of the footboard and headboard bottom rails, 3" from the top and centered end to end, where shown. Using the holes in the cleats as guides, drill pilot holes in the rails; then screw the cleats in place.

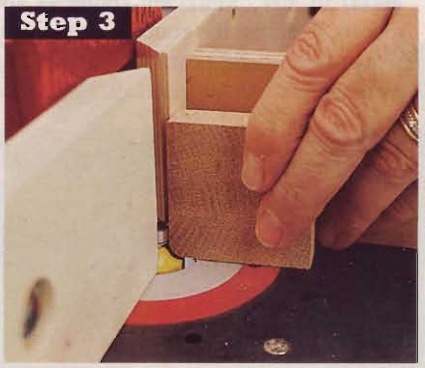
How to cut post caps in 4 quick steps



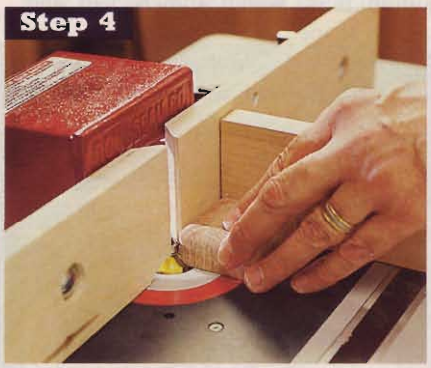
Chuck a ½" round-over bit in your table-mounted router. With your fence(s) flush with the bit's pilot bearing, round over all edges of the blank at both ends. Use a backer board to prevent tear-out.



Cut a 1" length from each end of the blank to separate two post cap pieces. Use a gauge block for consistent cuts. Position the block behind the saw blade so the cap cannot become pinched.



Without moving your router table fence, refit your router with a ¼" round-over bit. Now, with each cap vertical, round over its corners, again using a backer board for support and to prevent tear-out.



Using the same router table setup, place each cap bottom face down on the table, and rout a ¼" round-over on its bottom edges. Repeat Steps 1–4 to shape additional caps.

Fashion the post caps

1 From ¼"-thick oak, cut the post cap bases (L) to size. To form the caps (M), first laminate three ¾"-thick pieces to form a 2¼×2¼×18" blank the same way you made the legs. Then, form the caps from the blank as shown in the sidebar, "How to cut post caps in four quick steps," *below left*. Make a few extra cap blanks in case any get damaged during machining.

2 Sand the edges of the caps and the transitions from the ¼" to ½" round-overs smooth. Then, glue and clamp a base (L), centered, on the bottom of each cap.

3 Clamp a cap in the hole-drilling jig with the base against the jig handle. Drill ¼" and ½" holes ⅞" deep in the cap to receive an alignment pin (N) and a cap dowel (O), where shown on **Drawing 2a**. Repeat for all caps.

4 From oak dowels, cut the ¼"-diameter alignment pins and ½"-diameter cap dowels to the lengths listed. Glue a pin in each cap, using a vise or clamp to squeeze the pin into the hole. Then, glue a cap dowel in each cap.

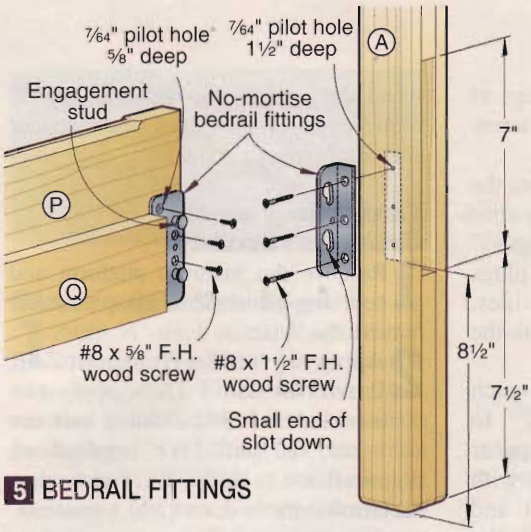
Add the bedrails and mattress platform

1 Cut the bedrails (P) to size. Using a stopblock with a 1"-long notch, rout ¼" stopped round-overs on all edges of the bedrails except for the bottom inside edge, where shown on **Drawing 2**.

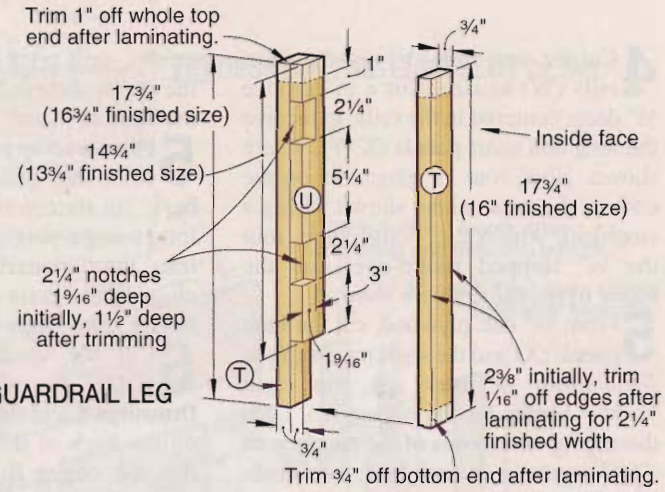
2 Cut the cleats (Q) to size. Rout a ¼" round-over on the bottom inside edge of the cleats, where shown. Drill countersunk shank holes in the cleats for the mounting screws, where shown. Position a cleat on the inside face of a bedrail (P) with the bottom edges flush and centered end to end. Using the holes in the cleat as guides, drill pilot holes in the bedrail, and drive in the screws. Assemble the other cleat and bedrail.

3 Position the bedrail fittings on the bedrails and legs, where dimensioned on **Drawing 5**. Centering on the holes in the fittings, drill pilot holes in the bedrails and legs to the depths shown, and drive in the mounting screws.

4 On a flat surface, assemble the bedrails to the headboard and footboard by engaging the bedrail fittings. Now, cut the mattress platform (R) to size, and lightly sand all edges. Cut a ¾×2¼" notch in each corner of the platform, where shown on **Drawing 2**. Drill



5 BEDRAIL FITTINGS



6 GUARDRAIL LEG

countersunk shank holes in the platform, where shown; then position it on the cleats. Using the holes in the platform as guides, drill pilot holes in the cleats to the depth shown, and drive in the screws. (You'll need to slightly angle your drill to clear the bedrail when drilling the holes.)

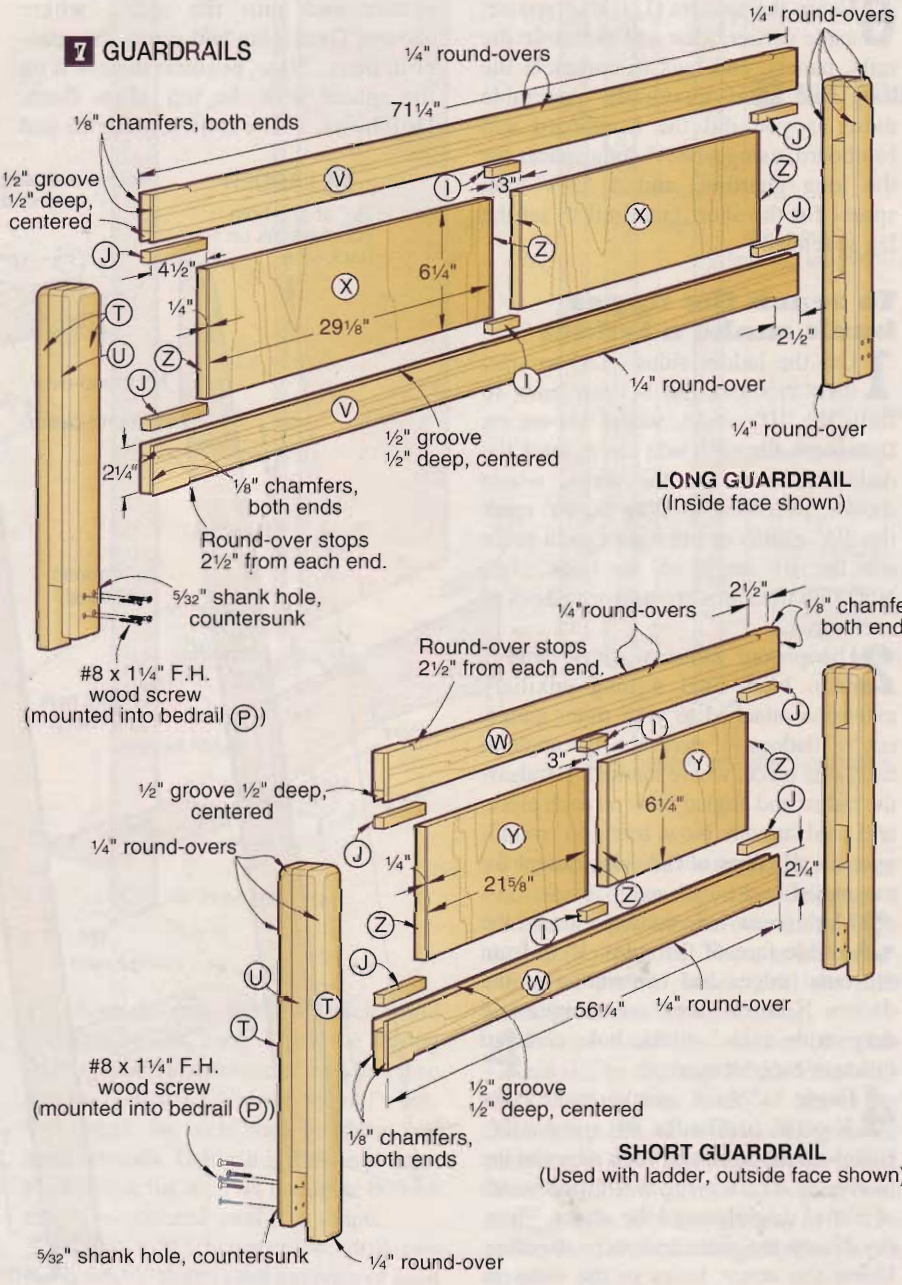
For bunk beds, make dowels and guardrails

1 From ½"-diameter oak dowel, cut the bed-joining dowels (S) to the length listed. Sand a light chamfer on both ends of the dowels to ease insertion into the legs.

2 From ¾"-thick stock, cut eight 2⅜×17¾" blanks for the guardrail outside legs (T) and four 2⅜×14¾" blanks for the inside legs (U).

3 Cut the notches in the inside legs, where dimensioned on **Drawing 6**. Now, apply glue and assemble the legs (T, U) in the configuration shown, keeping the ends and edges flush. As explained in the **Shop Tip** on *page 50*, nail only through the waste at the top end as you assemble the legs. Clamp the legs together, as in **Photo A**. When the glue is dry, joint or rip 1/16" of material off two edges of each leg for a 2¼"-square lamination, and cut the 1" of waste off the top. On the outside leg (T) of each leg assembly that will go inside the bed, trim ¾" off the bottom, where shown, to clear the mattress platform. Rout ¼" round-overs on the edges of the legs, where shown on **Drawing 7**. Then, drill countersunk shank holes in the lower face of the shortened outside legs (T) for attaching the legs to the bedrails.

7 GUARDRAILS



4 Cut the long rails (V) and the short rails (W) to size. Cut a ½" groove ½" deep, centered in the rails, to receive the long and short panels (X, Y), where shown. Now, rout ⅛" chamfers on the ends of the rails, where shown. Using a stopblock with a 2½"-long notch, rout the ¼" stopped round-overs on the edges of the rails, where shown.

5 From ½" oak plywood, cut the long panels (X) and the short panels (Y) to size. From ¼"-thick oak, rip eight ⅝×6¼" blanks for the edging (Z). Glue the edging to the ends of the panels with a 1/16" overhang on each face; then flush-trim the edging.

6 Using the spacers (I, J) that you set aside earlier, glue and assemble the rails, panels, and legs to complete the long and short guardrails. Assemble these as you did the headboard and footboard, using a 68¼"-long spacer for the long guardrail and a 53¼"-long spacer for the short guardrail to set the leg spacings.

To reach the upper bunk, make a ladder

1 Cut the ladder sides (AA) to size; then crosscut the bottom ends to form the 10° angle, where shown on **Drawing 8**. On each side piece, mark the dado locations for the steps, where shown. Referring to **Drawing 8a**, mark the 2⅛" radius at the top of each piece and the 10° angle on the back edge. Note that the sides are mirror images of each other.

2 Using your tablesaw fitted with a dado blade and a long auxiliary extension attached to your miter gauge, cut ¾" dadoes ¼" deep at a 10° angle in each side piece, where marked. Bandsaw the radius and angled back on each piece, and sand smooth. Now, rout a ¼" round-over on all edges of the sides except for the angled back.

3 Mark screw-hole centerpoints on the outside face of the sides, 1" in from the outer edges and centered over the dadoes. Now, drill a ⅜" counterbore 3/16" deep with a 5/32" shank hole centered inside at each location.

4 From ¾"-thick stock, make four 3⅞×14" blanks for the steps (BB). Bevel-rip the front and back edges of the blanks at 10°, leaving a finished width of 3 11/16". Lightly sand the edges. Then, dry-clamp the sides and steps together. Using the screw holes in the sides as guides, drill pilot holes in the steps to the depth shown. Now, glue and screw the steps in place.

5 From a scrap piece that matches the color and grain of the side members, cut sixteen ⅜"-diameter plugs ¼" long using a plug cutter. Glue the plugs into the counterbores in the sides, aligning the grain of the plugs with the ladder sides; then sand flush.

6 Cut the spacer (CC) and catch (DD) to size. Referring to **Drawings 8** and **8a**, position the spacer on the back of the side members with the top edges flush. Drill pilot and countersunk shank holes through the spacer and into the sides, where shown. Then, glue and screw the spacer in place. Now, position the catch on the spacer with the top edges flush. Drill holes, where shown, and glue and screw the catch to the spacer. Rout ¼" round-overs on the edges of the spacer and catch, where shown.

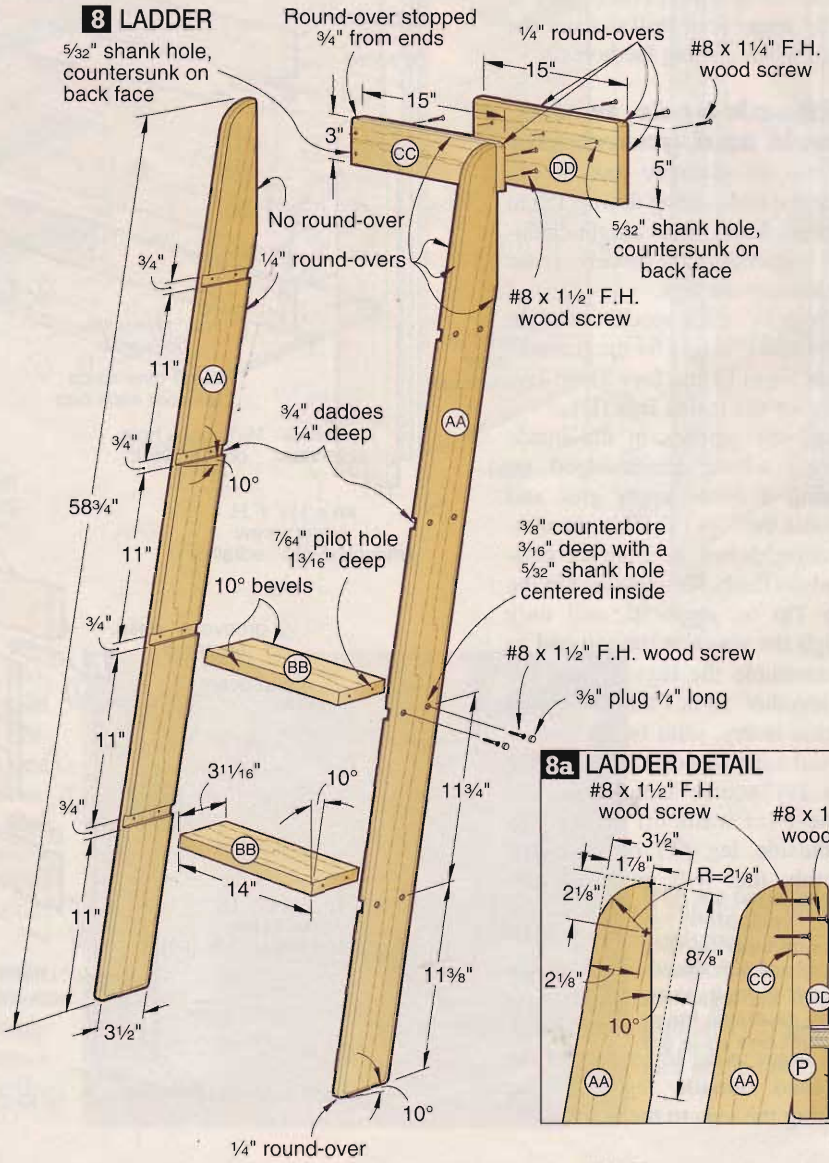
Finishing and final assembly

1 Remove the mattress platform and bedrails. Finish-sand all parts, and remove the dust.

2 Apply a stain. (We used ZAR Provincial stain.) Then, apply two coats of a clear finish, sanding between coats to 320-grit. (We brushed on polyurethane.) With the finish dry, reassemble the bed, and add a mattress.

Setting up bunk beds

1 Assemble the lower bed using both headboard assemblies, and assemble the upper bed using both footboard assemblies.

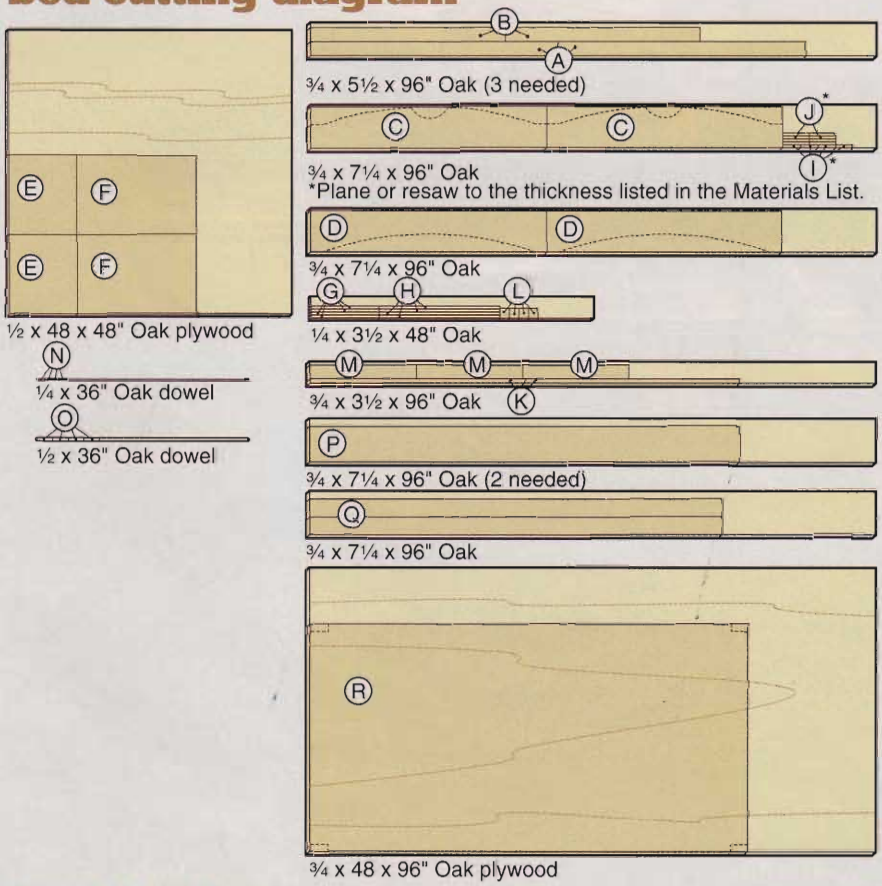


2 Position the guardrails on the bedrails of the upper bed with the short, drilled leg member on the inside. (You can mount the long and short guardrails on either side of the bed to suit your needs. Also, you can position the short guardrail toward either end of the bed, depending on where you want the ladder.) Using the holes in the legs (T/U) as guides, drill pilot holes on the inside face of the bedrails, and drive in the screws, shown on **Drawing 7**.

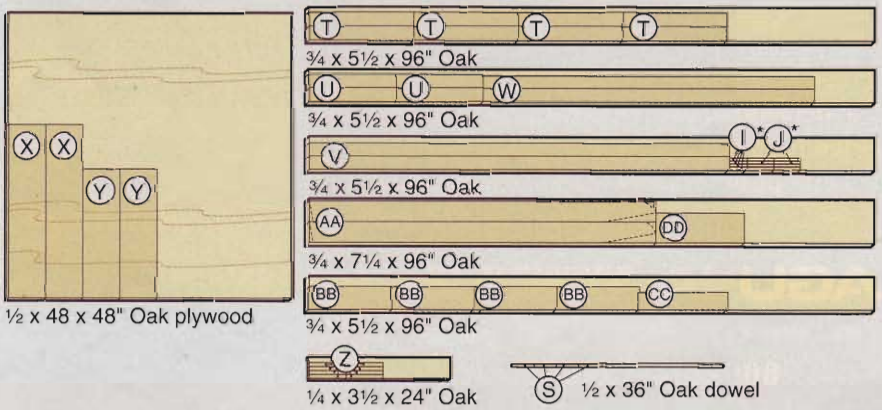
3 Insert a bed-joining dowel (S) in each of the lower bed's legs; then, with the aid of a helper, position the other bed on top. Attach the ladder to the upper bed. Finally, add mattresses; then call the kids and have them try out the beds.

Written by **Owen Duvall**
Project design: **Kevin Boyle**
Project builder: **Charles I. Hedlund**
Illustrations: **Roxanne LeMoine; Lorna Johnson**
Photographs: **Marty Baldwin**

bed cutting diagram



bunk bed cutting diagram



materials list

	FINISHED SIZE T	W	L	Matl.	Qty.
Parts for one twin-size bed					
Legs					
A* headboard legs	¾"	2¼"	40"	O	6
B* footboard legs	¾"	2¼"	31"	O	6
Headboard and footboard					
C top rails	¾"	7"	40"	O	2
D bottom rails	¾"	7"	40"	O	2
E footboard panels	½"	13½"	11½"	OP	2
F headboard panels	½"	13½"	20½"	OP	2
G* footboard edging	¼"	½"	11½*	O	4
H* headboard edging	¼"	½"	20½*	O	4
I† spacers	½"	½"	3"	O	4
J† spacers	½"	½"	4½"	O	8
K cleats	¾"	¾"	36½*	O	2
Post caps					
L bases	¼"	1⅝"	1⅝"	O	4
M caps	1"	2¼"	2¼"	LO	4
N alignment pins	¼" diam.		1⅝"	OD	4
O cap dowels	½" diam.		2¾"	OD	4
Bedrails and mattress platform					
P bedrails	¾"	6"	73"	O	2
Q cleats	¾"	3"	70"	O	2
R mattress platform	¾"	38½"	74⅜"	OP	1
Bunk bed parts					
Guardrails and bed-joining dowels					
S bed-joining dowels	½" diam.		3¾"	OD	4
T* outside legs	¾"	2¼"	16¾"	O	8
U* inside legs	¾"	2¼"	13¾"	O	4
V long rails	¾"	2¼"	71¼*	O	2
W short rails	¾"	2¼"	56¼*	O	2
X long panels	½"	29⅛"	6¼"	OP	2
Y short panels	½"	21⅝"	6¼"	OP	2
Z* edging	¼"	½"	6¼"	O	8
Ladder					
AA sides	¾"	3½"	58¾*	O	2
BB* steps	¾"	3 1/16"	14"	O	4
CC spacer	¾"	3"	15"	O	1
DD catch	¾"	5"	15"	O	1

*Parts initially cut oversize. See the instructions.

†For bunk beds, make a total of 12 spacers (I) and 24 spacers (J). This is enough for both beds and includes four spacers (I) and eight spacers (J) for the guardrails.

Materials Key: O–oak, OP–oak plywood, LO–laminated oak, OD–oak dowel.

Supplies: #8x⅝", #8x¾", #8x1¼", and #8x1½" flathead wood screws; white glue; ¼" hardboard.

Blades and Bits: Dado blade, chamfer bit, flush-trim bit, ¼" round-over bit, ½" round-over bit, ⅜" plug cutter.

Buying Guide

No-mortise bedrail fittings. Set of four (2 sets needed for bunk beds), no. 142496, $9.99 (per set) plus shipping. Order from Woodcraft, call 800/225-1153 or go to www.woodcraft.com.

traditional oak child's dresser

Fresh styling joins with ample storage in this five-drawer piece.

Part of our children's bedroom ensemble, this dresser matches the bunk beds on *page 48*, featuring the same groove-and-panel construction and decorative arch details. Its modest styling makes it a good fit in any setting.

For the items needed to build this project, see the Cutting Diagram and Materials List on *page 63.*

Start with the legs

1 From ¾"-thick stock, planed to ½", cut eight 1⅞×50⅝" blanks for the outside legs (A). From ¾"-thick stock, cut four blanks of the same size for the inside legs (B). All of the blanks are oversized ⅛" in width and 2" in length. The edges are jointed or ripped and the ends are trimmed after the legs are laminated, where shown on **Drawing 1**.

2 Cut the two notches in the inside legs, where dimensioned, using a bandsaw or a tablesaw fitted with a ¾" dado blade. The notches form mortises in the finished laminated legs.

3 To assemble the legs, first refer to the **Shop Tip** in the Bunk Beds project, *page 50*, for an easy way to keep the leg pieces aligned during lamination. Then, apply glue and assemble the legs (A, B) in the configuration shown on **Drawing 1**, keeping the ends and edges flush. (We used white glue, which has a longer working time, to assemble the legs.) Clamp the four legs together, as shown in **Photo A** in the Bunk Beds project, *page 50*. Remove excess glue from the edges and inside the mortises.

4 Joint or rip 1/16" from two sides of each leg, where shown, for a 1¾"-square lamination. Then, trim the bottom of each leg 2" below the lower mortise. Now, trim the top of each leg to the finished length of 48⅝". Finally, rout ¼" round-overs on all edges except the top.

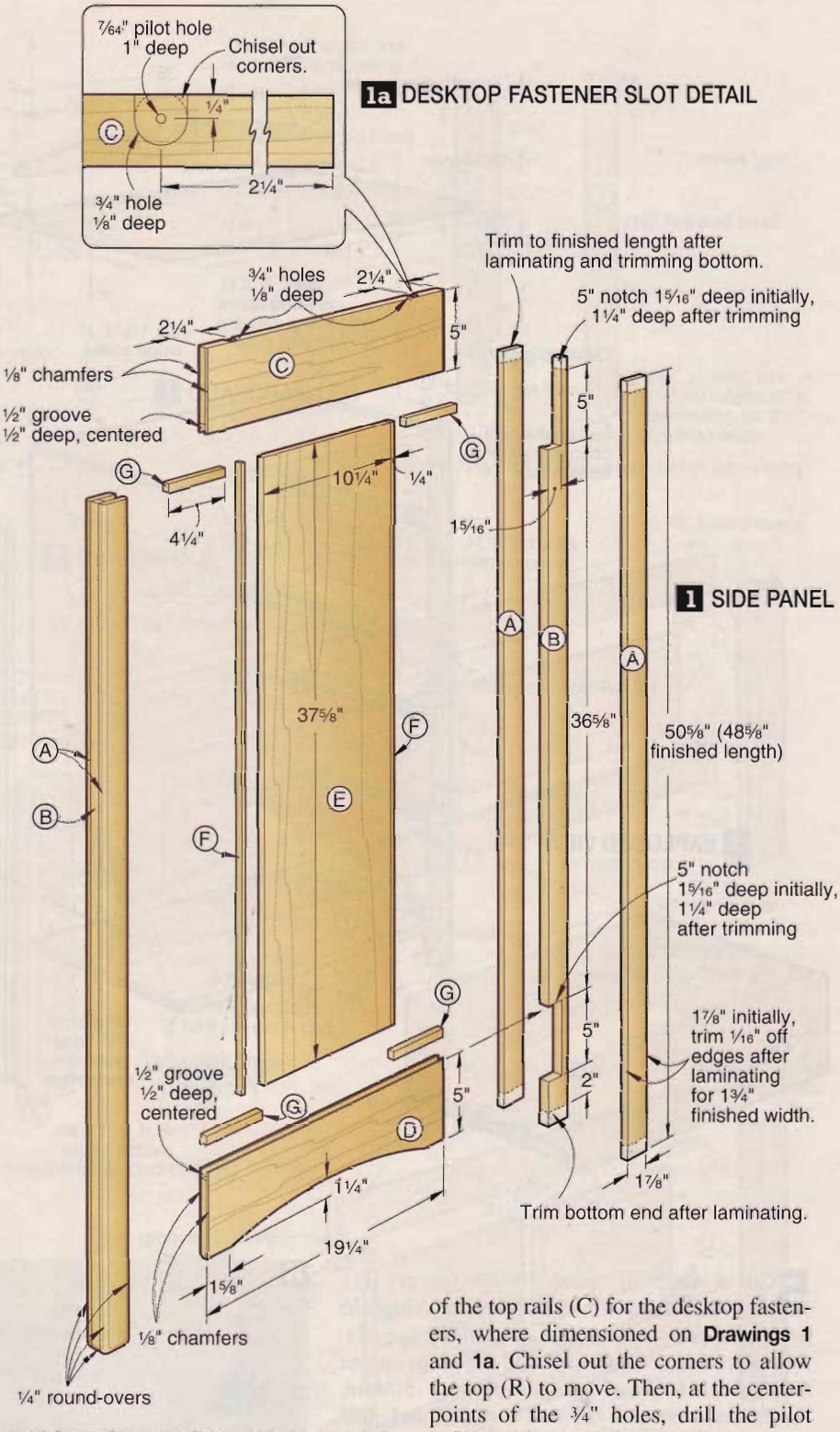
Complete the side-panel parts, and assemble

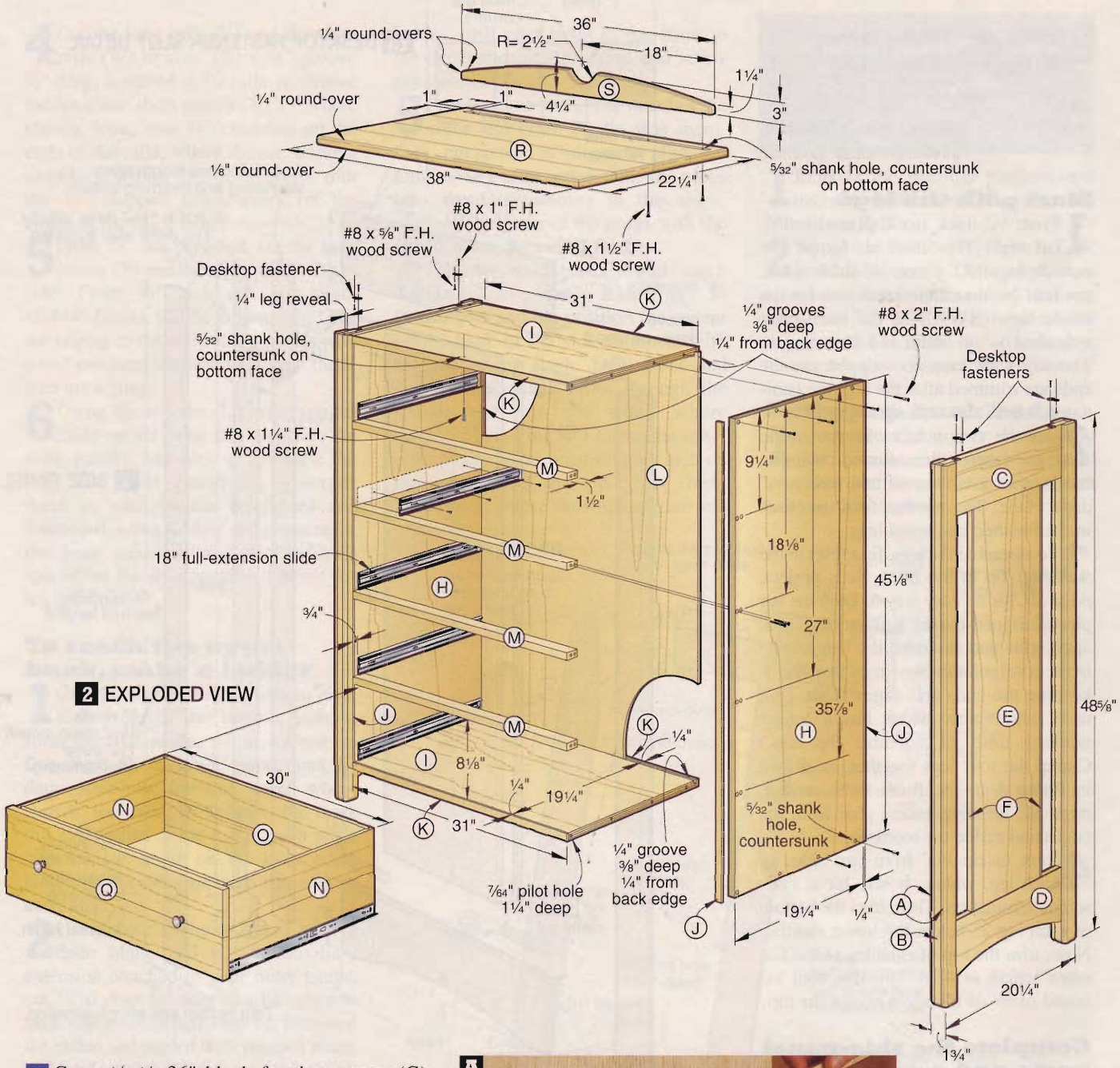
1 Cut the top rails (C) and the bottom rails (D) to the size listed in the Materials List. Then, cut a ½" groove ½" deep, centered in the rails, to receive the panel assemblies (E/F), where shown on **Drawing 1**. To ease insertion of the rails into the legs and provide room for glue squeeze-out, rout ⅛" chamfers on the ends of the rails, where shown.

2 Lay out the arch on the bottom rails, where shown. To do this, first clamp two ¾×1×2" stopblocks to a rail, one at each end of the intended arch, with the stopblocks' bottoms flush with the rail's bottom and their inside edges positioned 1¾" from the ends. Rip a ⅛"-thick wood fairing strip 20" long. Place the fairing strip against the stopblocks, and flex it so that the center is 1¼" from the rail's bottom. Mark the arch; then bandsaw and sand smooth. Using this rail as a template, mark the arch on the other bottom rail. Now, cut and sand it to shape.

3 Using a ¾" Forstner bit, drill two holes ⅛" deep in the top edge of each of the top rails (C) for the desktop fasteners, where dimensioned on **Drawings 1** and **1a**. Chisel out the corners to allow the top (R) to move. Then, at the centerpoints of the ¾" holes, drill the pilot holes for the mounting screws.

4 From ½" oak plywood, cut the panels (E) to the size listed. From ¼"-thick oak, rip four ⅝×37⅝" blanks for the edging (F). Glue the edging to the panels with a 1/16" overhang on each face. After the glue dries, trim the edging flush to the panels. (For an easy way to do this, make the flush-trimming fence, shown on *page 10* .)

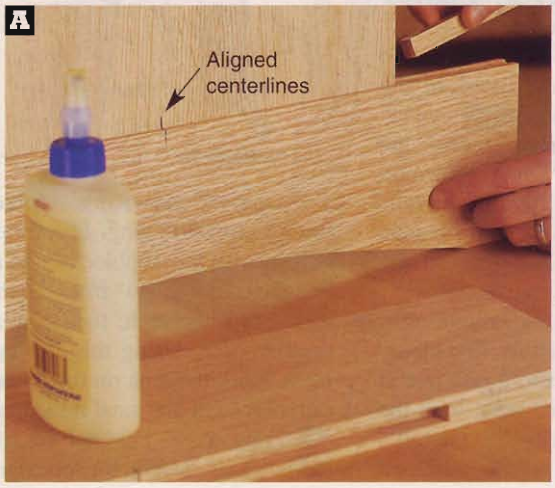




2 EXPLODED VIEW

5 Cut a ½×½×36" blank for the spacers (G); then cut them to size. Mark a centerline across the grain on one face of each top and bottom rail. Mark a centerline with the grain on one face of each panel at the top and bottom. Assemble a bottom rail and a panel, and glue spacers in the groove in the rail, as shown in **Photo A**. Clamp the spacers to the rail, remove the panel, and set the rail aside. Repeat to install the spacers in the other rails.

6 Apply glue in the grooves in a top and bottom rail and in the mortises in two leg assemblies. Assemble the rails, a panel, and the legs. Clamp the assembly, and check for square. Remove excess glue, and set aside. Repeat to assemble the other side panel.



With the panel and rail centerlines aligned, glue and clamp spacers in place, tight to the panel and flush with the ends and top surface of the rail.

Time for the carcase

1 From ¾" oak plywood, cut the carcase sides (H) and top and bottom (I) to size.

2 From ¼"-thick oak, cut four ⅞×45⅛" blanks for the side edging (J), and cut four ⅞×31" blanks for the top and bottom edging (K). Glue edging (J) to the sides, and glue edging (K) to the top and bottom, and trim flush when dry.

3 Cut a ¼" groove ⅜" deep and ¼" from the back edge in the sides (H) and top and bottom (I) to receive the back (L), where shown on **Drawing 2**. Then, cut the back and the dividers (M) to size.

4 To help you assemble and square the carcase, see the **Shop Tip**, *below*. Apply glue in the grooves in the sides, top, and bottom, and assemble the carcase with the back located in the grooves. Drill pilot and countersunk shank holes through the sides and into the top and bottom, where shown, and drive in the screws.

Position the dividers in the carcase using two ¾×1½×8⅛" spacers. Clamp the carcase sides to snug the divider. Drill the holes and drive in the screws.

5 Make two spacers for positioning the dividers (M) in the carcase, as shown in **Photo B**. Starting at the bottom of the carcase, position the first divider on top of the spacers. Mark screw-hole centerpoints on the outside face of the side panels centered over the divider, where dimensioned on **Drawing 2**. Drill pilot and countersunk shank holes at the centerpoints, and drive in the screws.

Mask mating glue-joint areas along the front and back edges of the carcase sides and on the inside of the side-panel legs with easy-release painters' tape. Then, apply the stain.

Remove the spacers, set them on top of the divider, and install the next divider. Continue this process to install the remaining dividers.

6 Finish-sand the carcase and the side-panel assemblies to 220 grit, and remove all dust. Mask mating 1"-wide glue-joint areas on the carcase sides and side-panel legs, where shown in **Photo C**. Now, stain the inside of the side-panel assemblies; the outside of the carcase sides and the back (L); the front edges of the carcase; the dividers (M); and a 1"-wide area around the inside of the carcase at the front edge. (We used ZAR Provincial stain.)

7 With the stain dry, remove the tape. Position the carcase upside down on your workbench, and apply glue to the previously masked areas. Now, mate the side-panel assemblies to the carcase with the top edges flush and a ¼" leg reveal at the front and back. Then, clamp the assembly.

Make the drawers

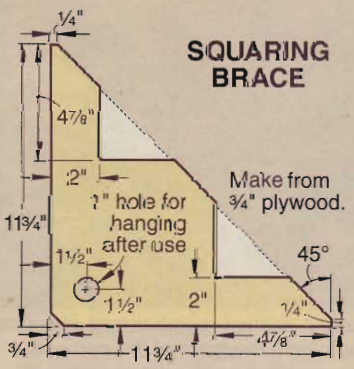
1 Edge-join enough ¾"-thick stock for the drawer sides (N) and fronts and backs (O). Plane to ½" thick; then cut the parts to size.

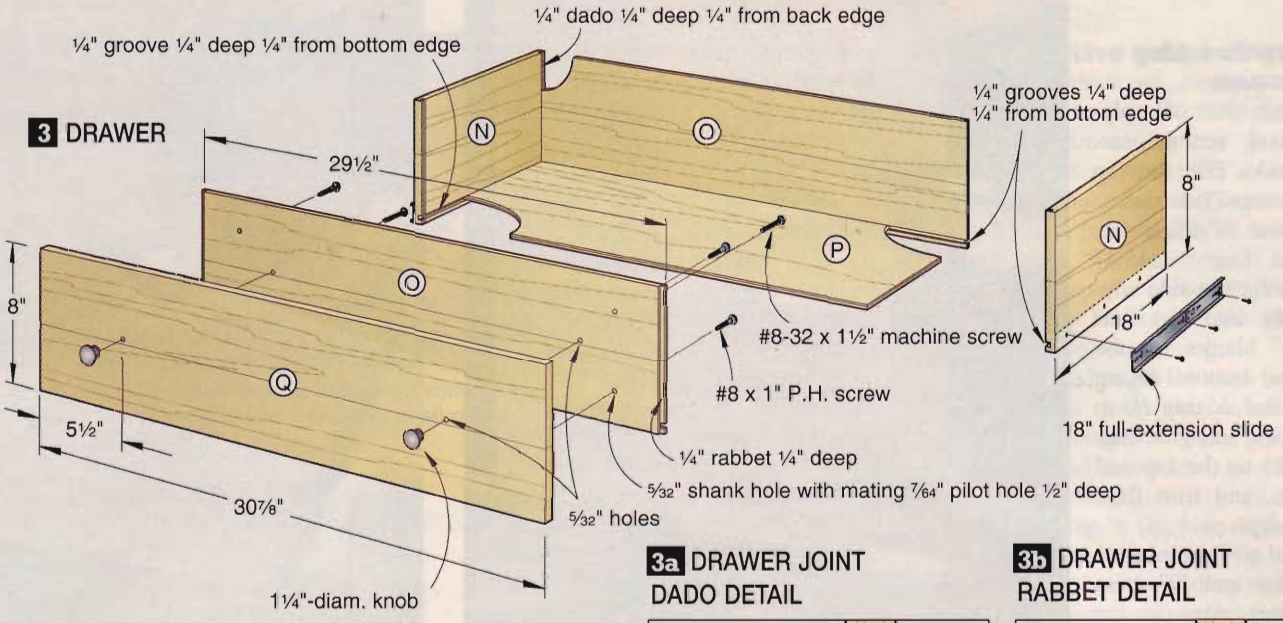
2 Cut a ¼" dado ¼" deep and ¼" from the ends of the sides (N) on their inside faces, where shown on **Drawing 3**. See **Drawing 3a** for the setup we used.

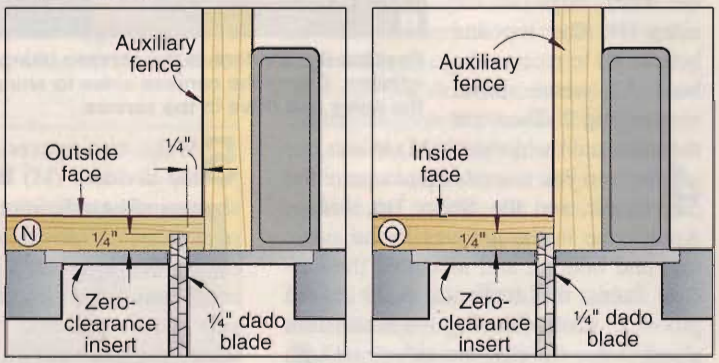
SHOP TIP

Squaring braces speed carcase assembly

Here's an easy way to square a carcase during assembly. Make four of the squaring braces, shown on the drawing, *below*. Then, as you assemble the panels, position a brace in each corner, and clamp it to the adjoining panels to square them, as shown in the photo, *right*.







Using the setup shown on **Drawing 3b**, cut a ¼" rabbet ¼" deep along the ends of the fronts and backs (O) on their outside faces. Finally, cut a ¼" groove ¼" deep and ¼" from the bottom edge of the sides and the fronts and backs to receive the bottoms (P). Cut the bottoms to size. Now, glue, assemble, and clamp the drawers, and check for square.

3 Position the full-extension slides on the drawer sides, where shown in **Photo D**, and attach with the supplied screws. Then, disconnect the larger cabinet-member part of the slides from the drawer member.

4 Install the cabinet-member part of the slides in the carcase, working from top to bottom. To do this, first measure from the top surface of the carcase bottom (I) to the top of the upper divider (M). From ¾"-thick scrap, cut a 2"-wide spacer to your measured length plus 1/16". Also, make two 1×2" spacers 1/16" thick from cardstock or plastic laminate, and set one spacer aside. Position a slide in the carcase, where shown in **Photo E**, and drive in the screws. (Note that the photo shows installation of a slide near the bottom with the wood spacer trimmed accordingly.) Repeat to install a slide on the opposite side. Then, repeat the process, trimming the spacer as necessary to install the remaining slides except for the bottom pair. For these, set them on the two 1/16"-thick spacers. Now, install the drawers.

5 Edge-join enough ¾"-thick stock for the drawer faces (Q). Then, cut the parts to size. Apply double-faced tape to the drawer fronts (O). Center each face in a carcase opening, and

Place a slide on a drawer side flush with the bottom and front edges. You'll need to open the slide a little to drive in the screws.

Locate the cabinet-member part of a slide ¾" back from the front of the carcase while supported on the wood spacer at the rear and 1/16"-thick spacer at the front.

press it onto the taped front. Now, carefully pull out a drawer and clamp the face and front. Drill holes from inside the drawer, where shown on **Drawing 3**, and drive the screws into the face. Then, drill two holes for the knob screws, where shown. Repeat for the remaining drawers.

Note: *We found it easiest to stain the drawer faces (Q) before installing them.*

Top it off

1 Edge-join enough ¾"-thick stock for the top (R), and cut to size. Rout a ¼" round-over on the top edges and a ⅛" round-over on the bottom edges, where shown on **Drawing 2**.

2 Cut the crest (S) to size. Mark the arch on the crest, where shown. (Use the technique that you used to mark the arch in the bottom rails, except you'll need a 40"-long fairing strip.) Using a compass, mark the curve in the center of the crest, where dimensioned. Bandsaw the top of the crest to shape, and sand to remove saw marks. Now, rout ¼" round-overs along the top edges and ends, where shown.

3 Position the crest on the top, where shown. Drill pilot and countersunk shank holes through the top into the crest, and drive in the screws.

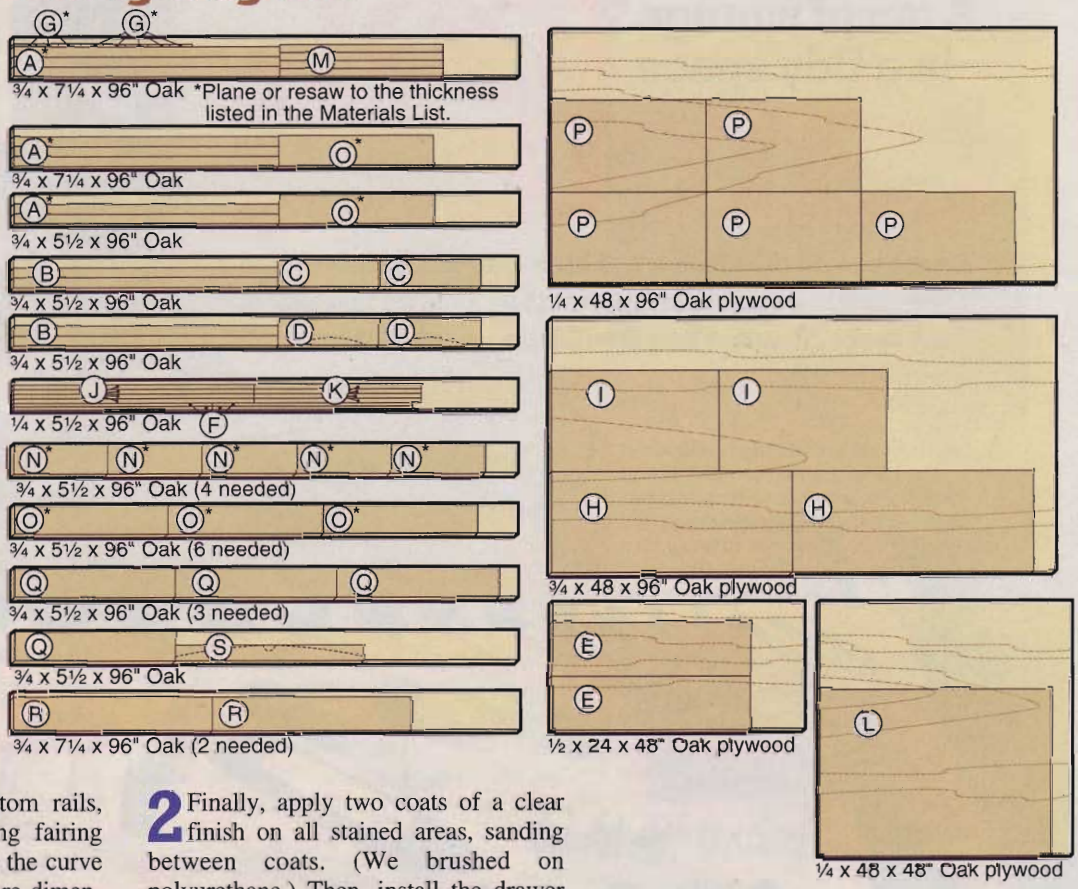
Note: *We found it easiest to stain the top assembly (R/S) before installing it.*

4 Screw the large end of the desktop fasteners to the top rails (C) with #8×1" flathead wood screws. Center the top assembly (R/S) on the dresser, and drive the #8×⅝" flathead wood screws through the small end of the fasteners into the bottom side of the top. From the bottom of the carcase top (I), drill a pilot and countersunk shank hole, where shown, and drive the #8×1¼" flathead wood screw through the carcase top and into the top assembly.

Final touches

1 Finish-sand any parts not previously sanded to 220 grit. Remove all dust. Then, apply stain to these parts and to the unfinished surfaces of the side-panel assemblies.

cutting diagram


G* G*
A* M
¾ x 7¼ x 96" Oak *Plane or resaw to the thickness listed in the Materials List.
A* O*
¾ x 7¼ x 96" Oak
A* O*
¾ x 5½ x 96" Oak
B C C
¾ x 5½ x 96" Oak
B D D
¾ x 5½ x 96" Oak
J K
¼ x 5½ x 96" Oak F
N* N* N* N* N*
¾ x 5½ x 96" Oak (4 needed)
O* O* O*
¾ x 5½ x 96" Oak (6 needed)
Q Q Q
¾ x 5½ x 96" Oak (3 needed)
Q S
¾ x 5½ x 96" Oak
R R
¾ x 7¼ x 96" Oak (2 needed)
P P P P P
¼ x 48 x 96" Oak plywood
I I H H
¾ x 48 x 96" Oak plywood
E E
½ x 24 x 48" Oak plywood
L
¼ x 48 x 48" Oak plywood

2 Finally, apply two coats of a clear finish on all stained areas, sanding between coats. (We brushed on polyurethane.) Then, install the drawer knobs with 1½" machine screws.

Written by **Owen Duvall**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**
Photographs: **Marty Baldwin**

materials list

Side Panels	FINISHED SIZE T	W	L	Matl.	Qty.
A* outside legs	½"	1¾"	48⅝"	O	8
B* inside legs	¾"	1¾"	48⅝"	O	4
C top rails	¾"	5"	19¼"	O	2
D bottom rails	¾"	5"	19¼"	O	2
E panels	½"	10¼"	37⅝"	OP	2
F* edging	¼"	½"	37⅝"	O	4
G* spacers	½"	½"	4¼"	O	8
Carcase					
H sides	¾"	19¼"	45⅛"	OP	2
I top and bottom	¾"	19¼"	31"	OP	2
J* side edging	¼"	¾"	45⅛"	O	4
K* top and bottom edging	¼"	¾"	31"	O	4
L back	¼"	31¾"	44⅜"	OP	1
M dividers	¾"	1½"	31"	O	4
Drawers					
N* sides	½"	8"	18"	EO	10
O* fronts and backs	½"	8"	29½"	EO	10
P bottoms	¼"	17½"	29½"	OP	5
Q* faces	¾"	8"	30⅞"	EO	5

Top Assembly	FINISHED SIZE T	W	L	Matl.	Qty.
R* top	¾"	22¼"	38"	EO	1
S crest	¾"	3"	36"	O	1

*Parts initially cut oversize. See the instructions.

Materials Key: O–oak, OP–oak plywood, EO–edge-joined oak.

Supplies: #8×⅝", #8×1", #8×1¼", #8×1½", and #8×2" flathead wood screws; #8×1" panhead screws; white glue; easy-release painters' tape.

Blades and Bits: Dado blade, chamfer bit, ¾" Forstner bit, flush-trim bit, ¼" round-over bit, ⅛" round-over bit.

Buying Guide

Hardware. Desktop fasteners, no. KV1547 (4); 1¼"-diam. solid brass knobs with satin chrome finish, no. A01950 G10 (10) with #8-32×1½" machine screws; 18" full-extension slides, no. KV8400 B18 (5 pr.) with screws. Order kit no. KIT1002, $76.95 ppd., from Woodworker's Hardware. Call 800/383-0130 or go to www.wwhardware.com.

A ton of storage in a tidy space tool carousel

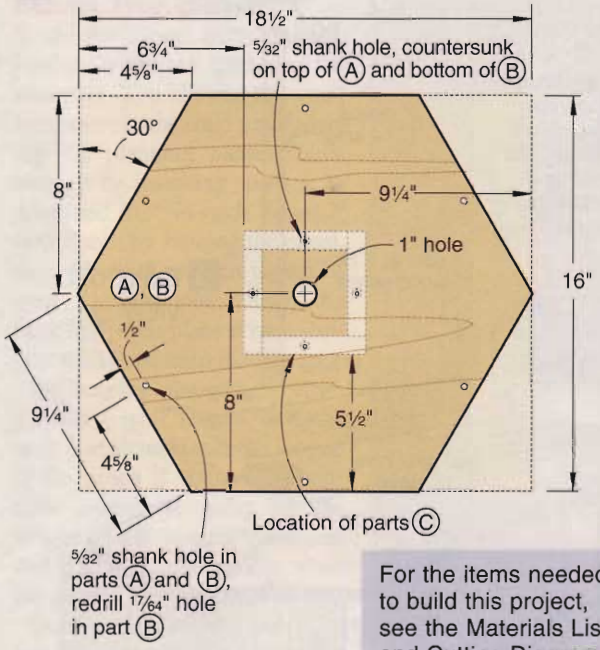
We packed all these tools and bits—135 pieces total—into an instant-access storage unit that takes up just 2x2' of wall space. Think of how it will help organize your shop!

Jon Svec
Projects Editor

Spin the entire carousel to access each of its six tool-holding wings ...

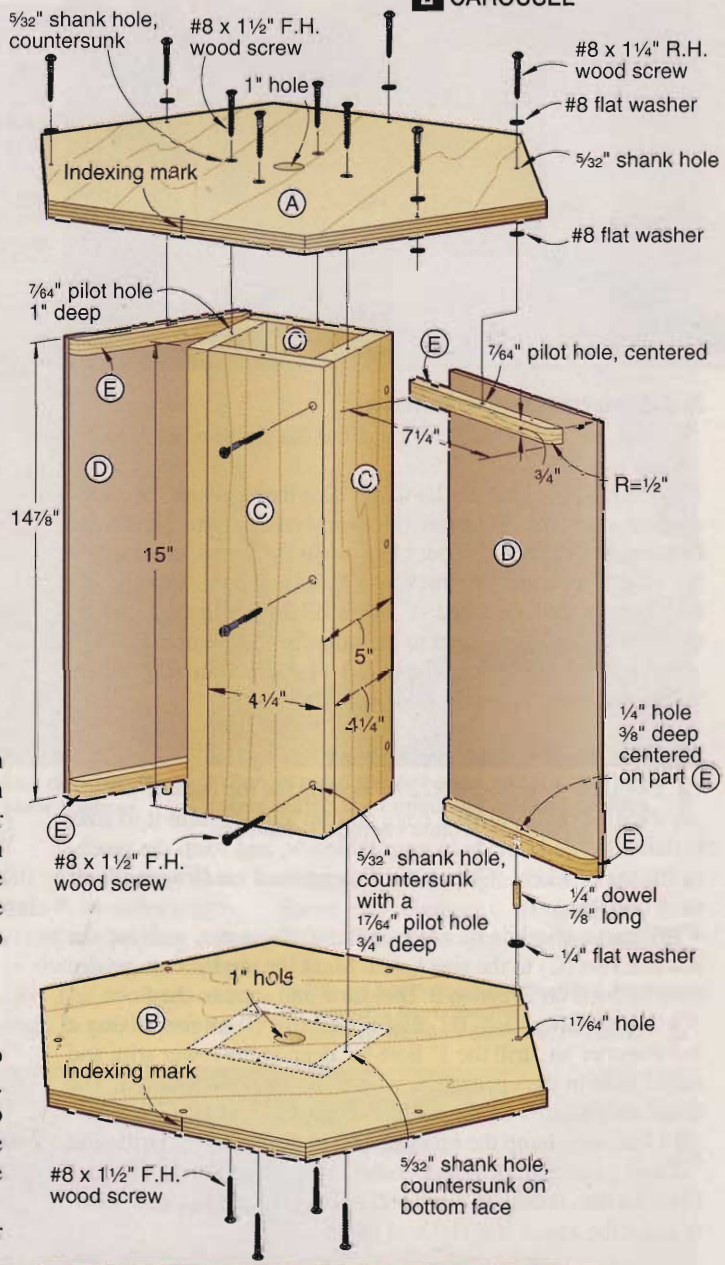
... and rotate each wing to access both of its sides and the center column.

1 TOP AND BOTTOM



For the items needed to build this project, see the Materials List and Cutting Diagram on *pages 66 and 67.*

2 CAROUSEL



This handy shop helper is the brainchild of reader Jim Maw of Kleinburg, Ontario. His ingenious design earned the prize for "Best Storage Solution or Organizer for Power Tool Accessories" in our Great American Workshops Contest. (See issue 140, pages 72–77 for all the winners and prizes.) We liked Jim's organizer so much that we obtained the design rights from him, then built one ourselves so that we can present the plans here.

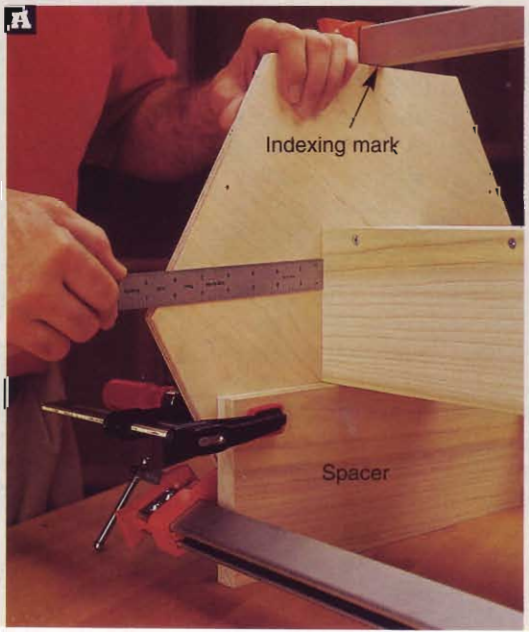
Start with the carousel

1 To make the top (A) and bottom (B), stick together two ½×16×18½" pieces of plywood with double-faced tape. Mark the top one "A" and the bottom one "B." Referring to **Drawing 1**, lay out the hexagonal shape and location of the holes on the top (A). Bandsaw close to the line, then sand the top and bottom to shape.

2 Drill the six 5/32" holes around the perimeter and the four 5/32" holes around the center through both parts. Countersink the center holes on the top surface of part A and the bottom surface of part B. Drill the 1" hole at the center. Make indexing marks across one edge of the joined parts for later reference. Separate the parts. Enlarge the perimeter holes in the bottom (B) to 17/64".

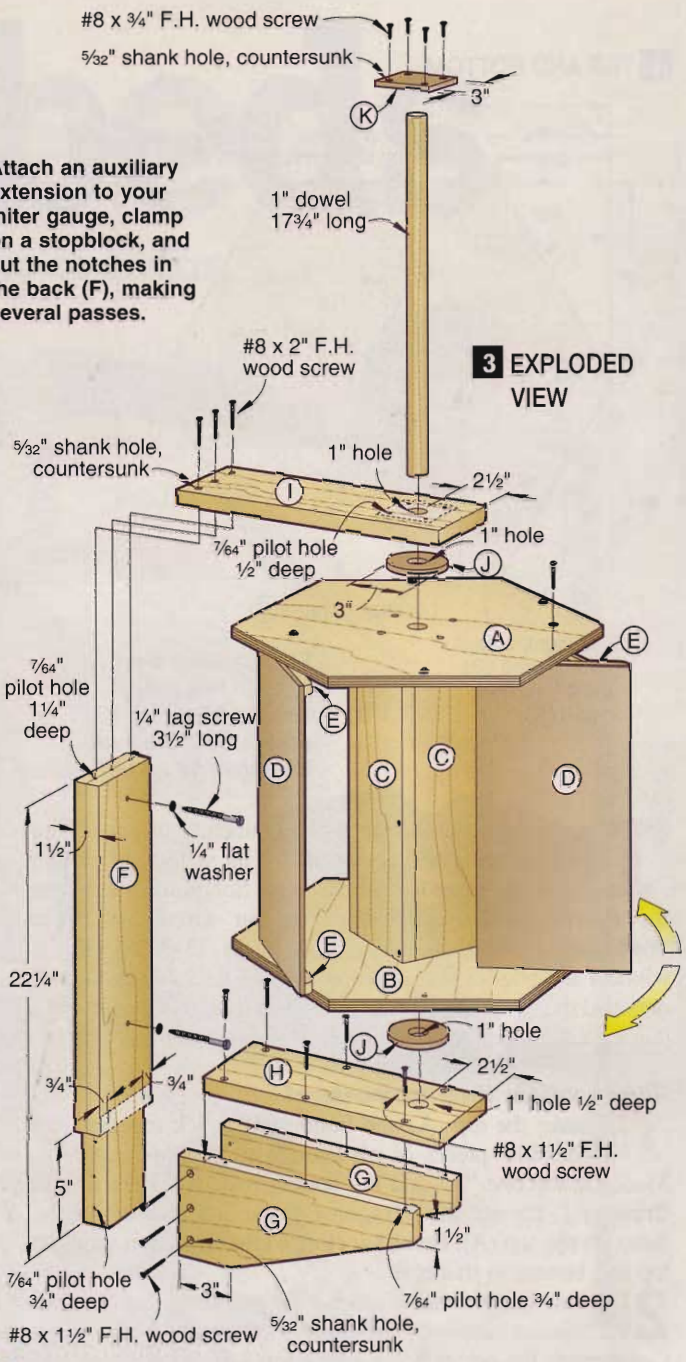
3 Cut the core sides (C) to the size given on the Materials List. Glue and clamp the core together in the configuration shown on **Drawing 2**. Make sure the ends are flush. Drill pilot and countersunk shank holes where shown, and drive in the screws. Remove the clamps.

4 To position the core between the top (A) and bottom (B), cut two ¾×5½×13½" spacers. Make the spacers from poplar. [You can rip them later to 5" wide for the brackets (G).] Clamp the core between the top and bottom, positioning it as shown in **Photo A**. Using the countersunk shank holes in the top and bottom as guides, drill pilot holes into the ends of the core, and drive in the screws.



With the indexing marks on the top (A) and bottom (B) facing upward, use spacers to position the core parallel to two sides. Measure in from the points, centering the core.

Attach an auxiliary extension to your miter gauge, clamp on a stopblock, and cut the notches in the back (F), making several passes.



Add rotating panels

1 From ¼" tempered hardboard, cut the six panels (D) to the size listed.

2 Cut the panel cleats (E) to the size listed. Mark, bandsaw and sand the ½" radii on their ends, where shown on **Drawing 2**. For the six upper cleats, drill 7/64" holes, centered on the length and the ½" thickness, where shown. For the six lower cleats, drill centered ¼" holes ⅜" deep. Cut six ¼" dowels ⅞" long and glue them in the holes in the lower cleats.

3 Glue and clamp the cleats (E) to the panels (D), where shown. Set the panels aside.

Make the wall bracket

1 Laminate two ¾×5¼×22½" boards for the back (F). With the glue dry, joint one edge and rip and crosscut it to size. Install a ¾" dado blade in your tablesaw, and form the notches for the brackets (G), where dimensioned on **Drawing 3**, as shown in **Photo B**.

2 Retrieve the boards used earlier for spacers, and cut the brackets (G) to the size listed. Mark the angled cuts, where dimensioned on **Drawing 3**. Bandsaw and sand to the lines.

3 Cut the lower arm (H) and upper arm (I) to size. Using a Forstner bit, drill the 1" hole ½" deep in the lower arm, and the 1" hole in the upper arm, where shown on **Drawing 3**. The holes are centered on the widths of parts H and I.

4 Glue and clamp the brackets (G) to the back (F). Drill pilot and countersunk shank holes, and drive in the screws. Remove the clamps. In similar fashion, glue, clamp, and screw in place the lower arm (H) and upper arm (I).

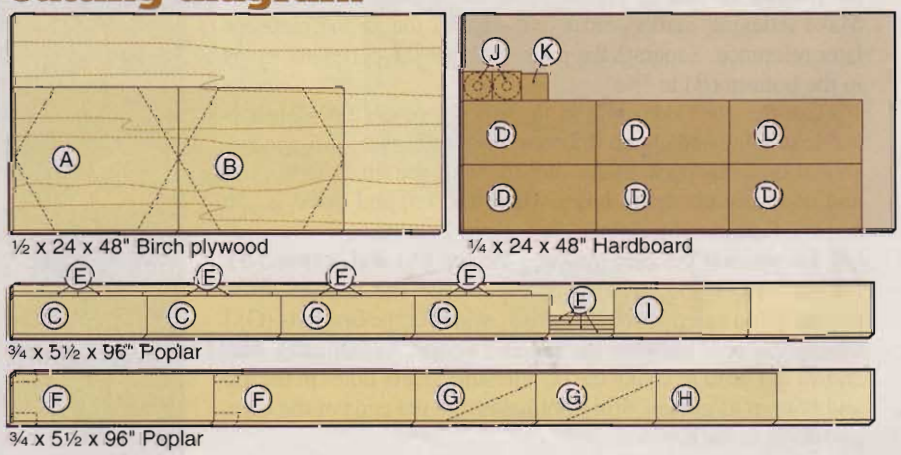
Finish and mount the carousel

1 Sand all the parts to 220 grit, easing the edges with a sanding block. Apply the finish of your choice. We brushed on two coats of satin polyurethane, sanding lightly with 220-grit sandpaper between coats. You can also prime and paint to match existing cabinetry.

2 Cut two ¼×3¼×3¼" hardboard blanks for the washers (J). Mark their centers, and draw 3"-diameter circles. Drill centered 1" holes, and bandsaw the washers to shape.

3 Cut the cover plate (K) to size. Drill countersunk shank holes at the four corners, where shown on **Drawing 3**.

cutting diagram



4 With the finish dry, drill ¼" holes through the wall-bracket back (F). Transfer these locations to the wall at a stud location. Drill pilot holes into the stud. Now fasten the wall bracket with ¼" lag screws 3½" long.

5 Cut a 17¾"-long piece of 1" dowel. Place the carousel between the upper and lower arms. Slide the washers (J) in place between the carousel and the arms. Drop the dowel in from the top, seating it in the hole in the lower arm (H). Center the cover plate (K) over the upper arm's dowel hole. Using the shank holes in the cover plate as guides, drill pilot holes, and drive in the screws.

6 Arrange your tools on the panels and make the holders. For the mounting methods we used, see the sidebar, *right.*

7 With the holders now attached to the panels, slip washers over the bottom cleats' ¼" dowels, and tip the panels into place, seating the bottom cleat dowels in the holes in the carousel's bottom (B). Slide a #8 flat washer between the top cleat and the carousel top (A), where shown on **Drawing 2.** Secure the panels to the top (A) with flat washers and roundhead screws. Attach the tools and bits.

Written by **Jan Svec** with **Charles I. Hedlund**
Project design: **Jim Maw**; **Kevin Boyle**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**
Photographs: **Marty Baldwin**

materials list

Part	FINISHED SIZE T	W	L	Matl.	Qty.
A top	½"	16"	18½"	BP	1
B bottom	½"	16"	18½"	BP	1
C core sides	¾"	4¼"	15"	P	4
D panels	¼"	7¼"	14⅞"	H	6
E panel cleats	½"	¾"	7¼"	P	12
F* back	1½"	5"	22¼"	LP	1
G brackets	¾"	5"	13½"	P	2
H lower arm	¾"	5"	13½"	P	1
I upper arm	¾"	5"	15"	P	1
J* washers	¼"	3"	diam.	H	2
K cover plate	¼"	3"	3"	H	1

*Part initially cut oversize. See the instructions.

Materials Key: BP–birch plywood, P–poplar, H–tempered hardboard, LP–laminated poplar.

Supplies: #8x¾" flathead wood screws (4), #8x1½" flathead wood screws (32), #8x2" flathead wood screws (3), #8x1¼" roundhead wood screws(6), #8 flat washers (12), ¼" flat washers (2), ¼" lag screws 3½" long (2), ¼" dowel, 1" dowel.

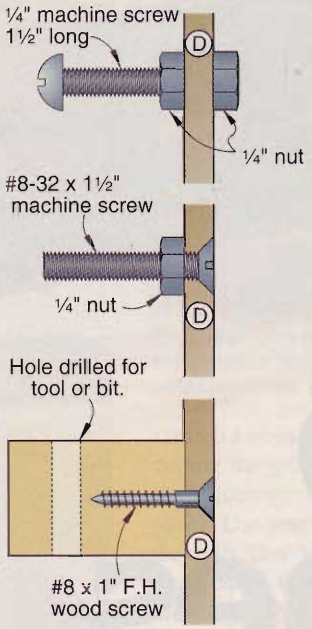
Blades and bits: Stack dado set, 1" Forstner bit.

Buying Guide

Tool Holders. Look for spring-clip tool holders and magnetic tool holders at your local hardware store, home center, or woodworking specialty store.

Adding your tools and bits

4 TOOL MOUNTING OPTIONS



How many of the hundred-plus small items that clog the drawers in your shop can you fit onto your carousel? To plan the arrangement of your tools and bits, place the panels (D/E) on your workbench, and position the items, as shown in **Photo C.** You can store items on both sides of each panel, and also on the core.

Note: *For the panels to rotate, there must be clearance between each panel and the core. No bit, tool, or tool holder may protrude beyond an imaginary 8"-diameter cylinder, centered on the panel. Items stored on the core must not interfere with the panels' rotation.*

For tools that can hang from a peg or pegs, mark the locations, and drill holes through the panels. Insert machine screws, and thread on nuts, as shown on **Drawing 4.**

For drill bits and other tools that fit in round holes, measure the bit or tool center-to-center distances, and transfer these dimensions to blocks of wood. Drill holes slightly larger than the bit-shank or tool diameters. Clamp the holders to the panels. Drill pilot and countersunk shank holes from the opposite side, and drive in screws, where shown. (We didn't glue the holders in place, just in case we ever need to rearrange our layout.)

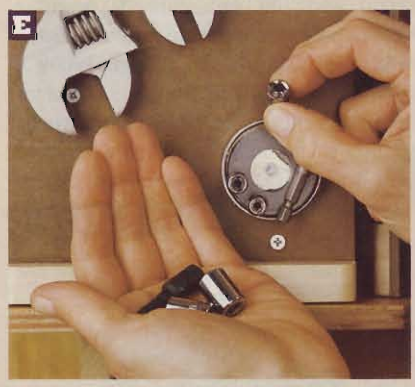
C

Arrange the bits or tools you wish to store in the carousel on the panels. Leave enough clearance between items to allow for easy handling.

D

After fastening spring-clip tool holders to the panel with machine screws and nuts, snap the tools in place.

E



To avoid having to make intricate holders for small or odd-shaped parts, mount a magnetic tool holder with a machine screw and nut.

If some of your tools have their own small case or holder, you may wish to mount it to a panel. To permanently attach the case, drill holes through it and the panel, and fasten with machine screws and nuts. For removable attachment, adhere Velcro tape to the case and panel. Other easy mounting methods are to use spring clips, as shown in **Photo D,** and magnetic toolholders, as shown in **Photo E.**

With well-chosen scrap, try a whole new way to display your favorite photos.

quick & slick photo frames

Note: For information on cutting, edging, and drilling acrylic sheet, see the article on page 70.

These great-looking photo frames are so easy to make, you'll be turning them out for everyone on your gift list. We've designed frames to fit single 5×7" photos, shown *below* in cherry, and the increasingly popular 4×11¾" panoramic photos, shown *above* in bird's-eye maple and wenge; but it's easy to custom-build a frame of any size. Cut the acrylic panes (C) to the dimensions of your photo plus 2" in length and width. Allow 1" between multiple photos in the same frame. Then, make the cap and base (A) 1½" longer than the width of the panes. All the other dimensions remain as shown on the Materials List.

Make a cap and a base

1 Cut the cap/base (A) to the size shown on the Materials List. Install a chamfering bit in your table-mounted router, and adjust it to cut a ⅜" chamfer. Set the fence flush with the bit's pilot bearing. Using your miter gauge fitted with an auxiliary extension to back the cuts, rout the end chamfers. Then remove the miter gauge and chamfer the edges.

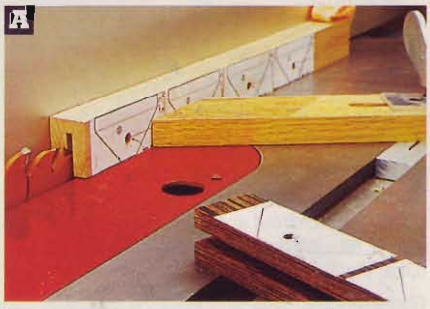
2 Resaw and plane a ¾×2×12" piece of stock to ⅜" thick for a blank for the feet (B). Cut the feet to size. Glue and clamp them to the base, where shown. Sand the edges of the base and feet flush. Finish-sand the cap and base to 220 grit.

3 Acrylic sheet comes with a protective covering. Leaving it in place, cut two pieces of 3/32"-thick (.093") clear acrylic 1/16" larger in length and width than the size listed for the panes (C). Joint 1/32" off all four edges of both pieces. Use a sanding block and 320-grit sandpaper to remove the sharp edges.

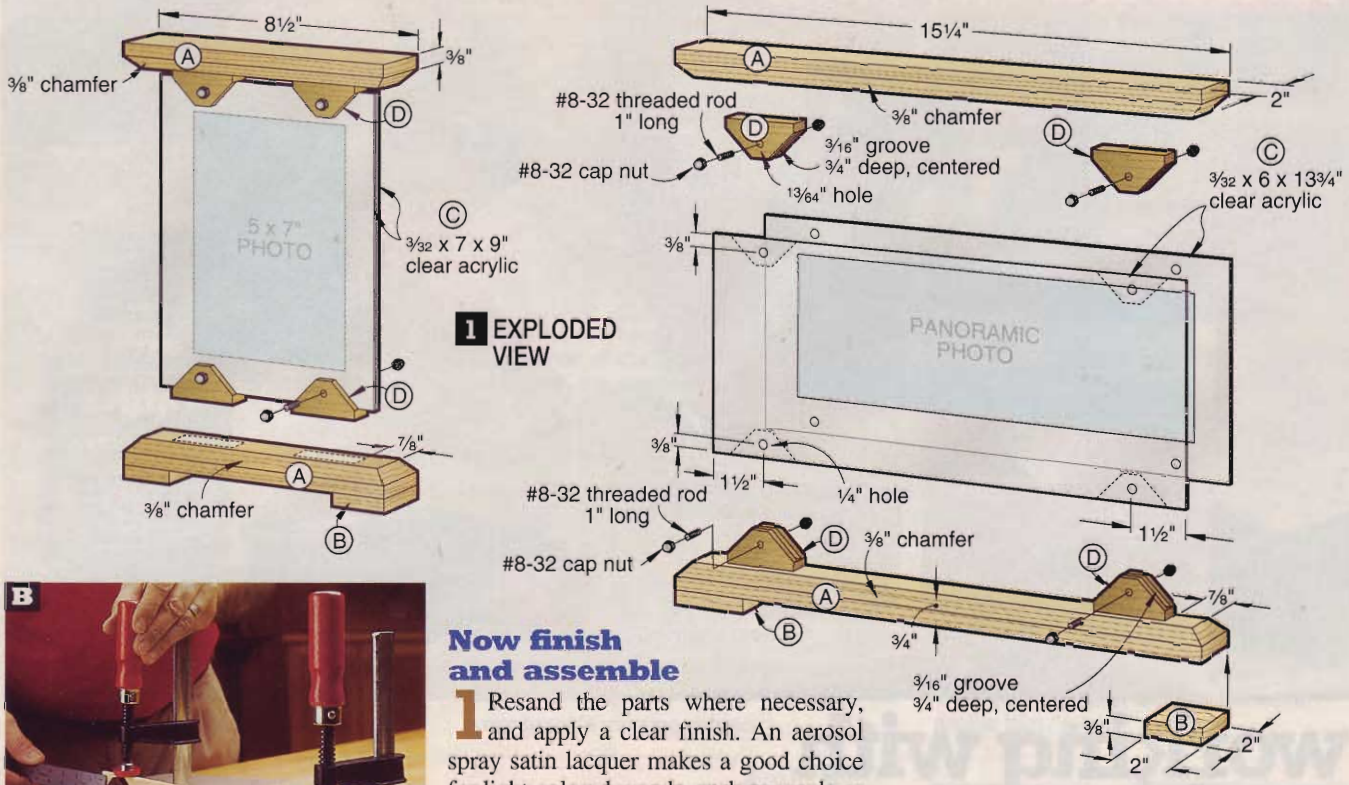
4 Cut a ¾×1×10½" blank for the brackets (D). Make four copies of the bracket full-size pattern on the *WOOD PATTERNS®* insert. Adhere the patterns side-by-side to the blank with spray adhesive. Align all four bottom edges. With your drill press, drill the 13/64" holes, where shown on the patterns.

5 First testing your cuts in a piece of scrap the same thickness as the bracket blank, cut a 3/16" groove ¾" deep centered in the blank, as shown in **Photo A**. The two acrylic panes with their protective covering in place should make a snug fit in the groove. (The photograph will compensate for the thickness of the covering when it is removed.)

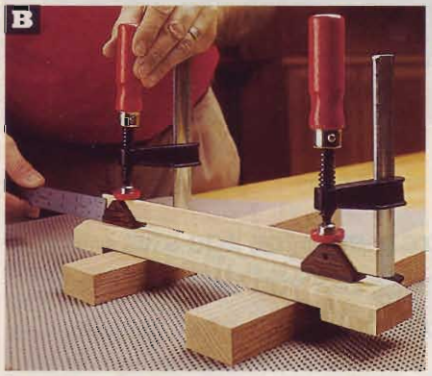
6 Bandsaw the brackets (D) from the blank, cutting close to the pattern lines; then, sand to the lines. Remove the patterns, and finish-sand to 220 grit.



To cut the centered groove, make two passes over your regular blade, turning the opposite face of the blank to the fence on the second pass.



1 EXPLODED VIEW



B

Center the brackets on the cap and base, and set them in 7/8" from the end bevels. A strip of wood that fits snugly in the brackets' groove keeps them aligned.

7 Glue and clamp the brackets to the cap and base, where shown on **Drawing 1**. Use a strip of wood to keep the brackets aligned, as shown in **Photo B**. Wipe off any glue squeeze-out with a damp cloth.

Now finish and assemble

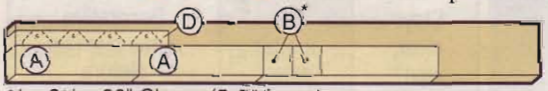
1 Resand the parts where necessary, and apply a clear finish. An aerosol spray satin lacquer makes a good choice for light-colored woods, such as maple or ash. To enhance the tone of darker woods, such as cherry, walnut, or oak, use an aerosol satin polyurethane. Give the parts three coats, lightly sanding with 320-grit sandpaper between coats.

2 Fasten the panes together face-to-face with masking tape, slide them into the base brackets, and put on the cap. Center the panes, and align the cap with the base. Using a felt-tipped marker, mark the locations of the bracket holes on the panes. Remove the panes, and drill 1/4" holes. Remove any burr with a countersink.

3 Remove the masking tape and the protective covering from the panes. To create the translucent white surround, place the back pane on a padded surface. Sand it on both sides with your random-orbit sander and a 180-grit disc.

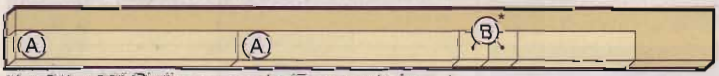
4 Cut four 1" lengths of #8-32 threaded rod, and thread a nickel-plated cap nut on one end of each piece. Wash and dry the panes. Position your photo(s) between the panes. Slide the sandwich into the base brackets, and add the cap. Insert the threaded rods, and secure them with four more cap nuts.

cutting diagram

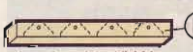


¾ x 3½ x 36" Cherry (5x7" frame)

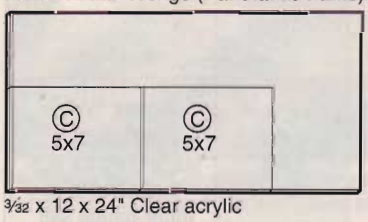
*Plane or resaw to the thickness listed in the Materials List.



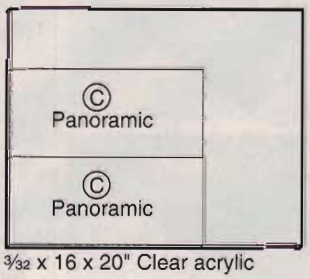
¾ x 3½ x 36" Bird's-eye maple (Panoramic frame)



¾ x 1 x 10½" Wenge (Panoramic frame)



3/32 x 12 x 24" Clear acrylic



3/32 x 16 x 20" Clear acrylic

Written by **Jan Svec** with **Charles I. Hedlund**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**
Photographs: **Marty Baldwin**

materials list

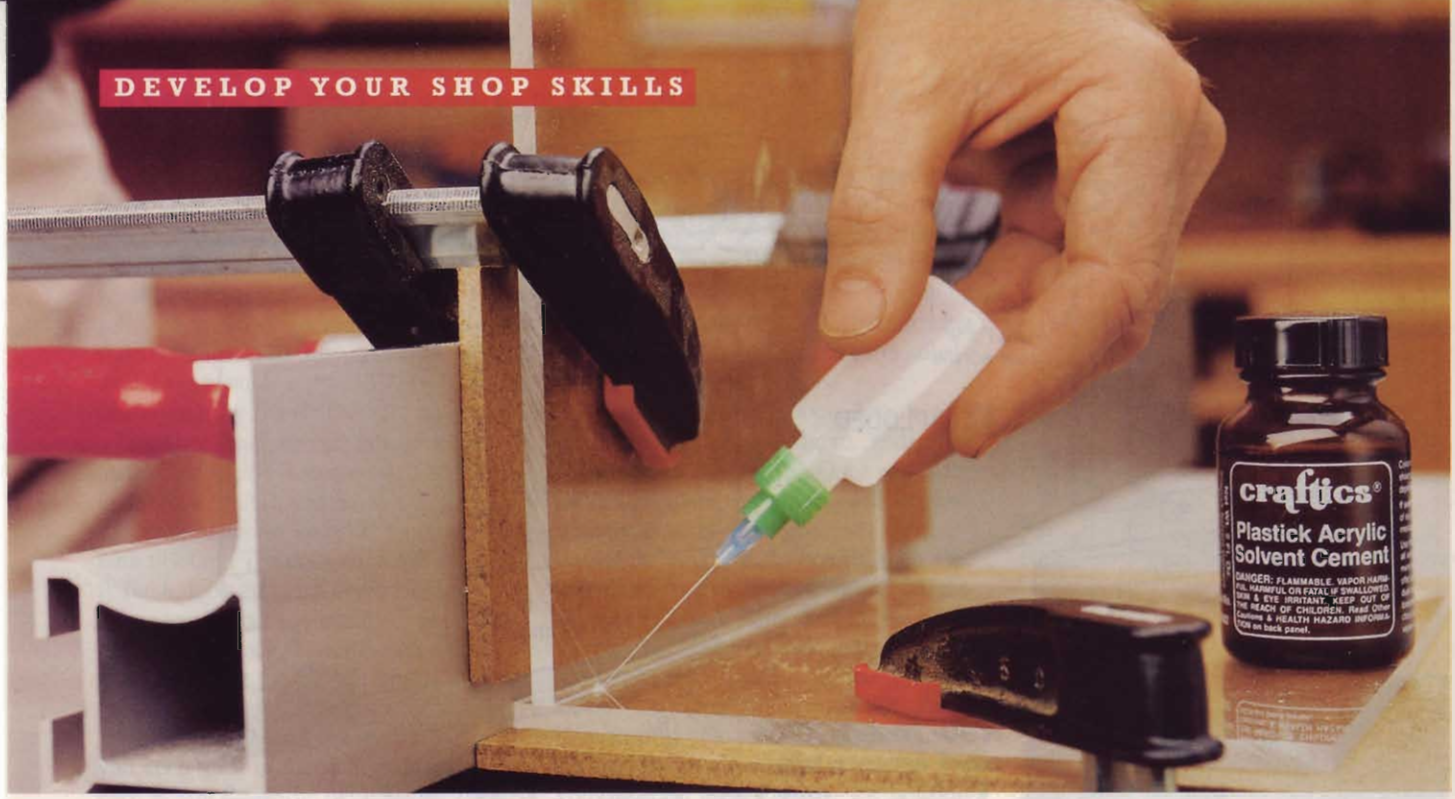
Frame 5x7"	FINISHED SIZE T	W	L	Matl.	Qty.
A cap/base	¾"	2"	8½"	C	2
B* feet	⅜"	2"	2"	C	2
C* panes	3/32"	7"	9"	A	2
D* brackets	¾"	1"	2"	C	4
Panoramic 4x11¾" frame					
A cap/base	¾"	2"	15¼"	M	2
B* feet	⅜"	2"	2"	M	2
C* panes	3/32"	6"	13¾"	A	2
D* brackets	¾"	1"	2"	W	4

*Parts initially cut oversize. See the instructions.

Materials Key: C–cherry, A–acrylic sheet, M–bird's-eye maple, W–wenge.

Supplies: Spray adhesive, #8-32 threaded rod (4 pieces 1" long for each frame), #8-32 nickle-plated cap nuts (8 for each frame).

Router Bit: 45° chamfer.



working with plastics

It's great stuff for jigs and projects, but you need the right approach for the best results.

Plastic may not possess the character and beauty of wood, but you'll never find a species of wood that's 100 percent waterproof; splinter-resistant; stable; and, depending on the type of plastic, transparent. When you need some or all of those characteristics for a jig or project, let this material see you through.

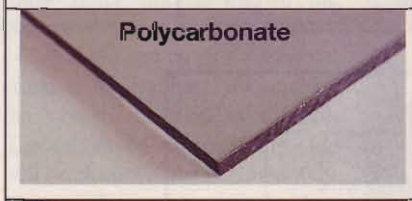
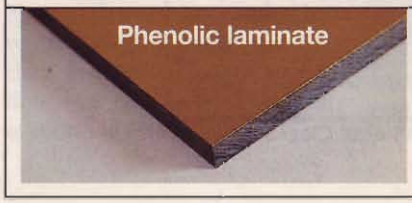
Here we'll focus on three types of plastic—acrylic, polycarbonate, and phenolic laminate—and how to machine, bond, and finish them. Acrylic is crystal-clear and rigid; polycarbonate looks like acrylic, but offers much greater resistance to impact; and phenolic laminate is opaque, has more strength than the other two, and won't melt as you machine it. When you need plastic, choose the best type with the help of the chart at *right*. Then adjust your cutting and shaping operations accordingly.

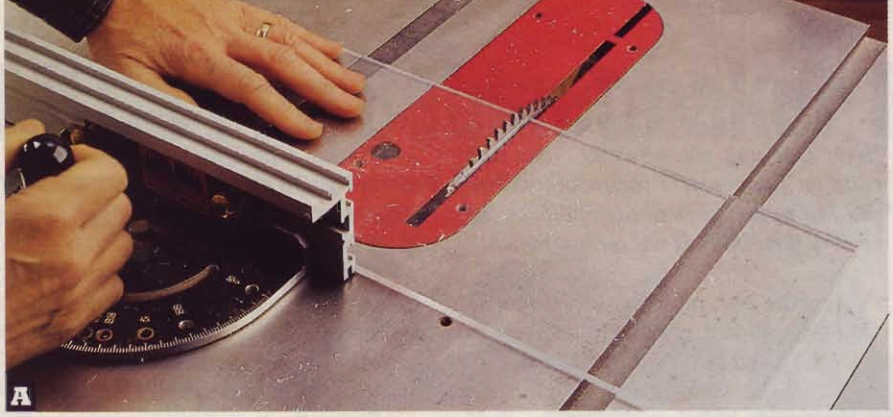
Cut with care

You can cut plastic with any of your power saws, or shape it with a router. Here are the keys to top results.

Tablesaw: An 80-tooth, triple-chip blade does an excellent job of cutting acrylic and polycarbonate on your tablesaw, as shown in **Photo A**. When you cut phenolic laminate, however, avoid fine particles by using a 40-tooth or coarser blade, wear a dust mask, and provide good ventilation, because the dust irritates the lungs. The coarse blades also cut acrylic and polycarbonate, but leave a rougher edge and can chip the surface. If you have to use a coarse blade on

GUIDE TO THREE COMMON PLASTICS

TYPE	PROS	CONS	BEST USES
Acrylic	Stays clear, won't yellow	Can shatter when being machined	Decorative items such as picture frames and display cases
 Polycarbonate	High impact resistance	Tends to "grab" bits and blades	Machinery guards
 Phenolic laminate	Strongest of the three; will hold threads	Sawdust is a strong lung irritant	Router table insert plates; guide bars for jigs that slide in a miter-gauge slot



Any tablesaw blade will slice through plastic. However, a blade with many fine teeth, such as this 80-tooth, triple-chip model, gives you a much smoother result.

those plastics, cut the workpiece oversize and trim it on the jointer. Or, use a straight router bit and router table; set the fence for a 1/16" cut.

Bandsaw: Use a skip-tooth blade, and match the coarseness to the thickness of the plastic. A blade with 10–14 teeth per inch (tpi) works great with 1/8" stock, while 1/4" material calls for only 6–8 tpi. If the plastic melts as you cut, you need a sharper blade or one with fewer teeth.

Scrollsaw: Melting can be a problem here, because you're always cutting with the same portion of the blade, and the friction heats it rapidly. Scrollsaw expert Rick Hutcheson recommends a speed of 1,000 strokes per minute or slower, a #5 double-skip-tooth blade, and two or three layers of masking tape or clear packing tape to absorb heat.

Router: You can shape plastic parts quickly with templates and a handheld router, as shown in **Photo B**, where we're using an old router table insert plate to shape a new one. Use bushings and straight bits or bits equipped with pilot bearings. Carbide bits spinning at high speeds give the smoothest results.

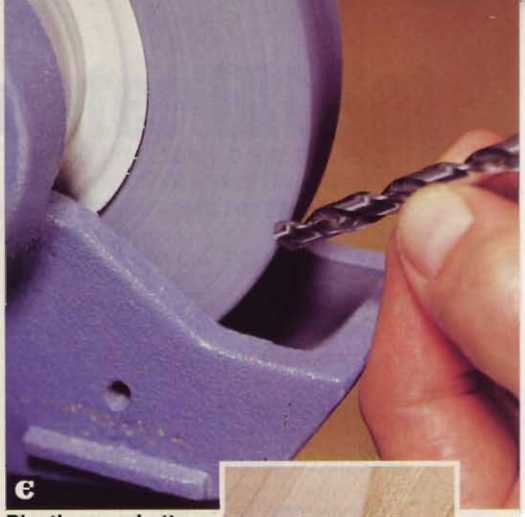
Drill clean holes

Slightly modify any twist bits that you want to use with plastic by carefully reshaping the cutting edges at the tip of the bit. Work both sides of the bit equally on the side of a fine grinding wheel, as shown in **Photo C**, to form a vertical scraping surface, as shown in **Photo D**. Now the bit will bore without chipping the edges of the hole.

Lubricate the bit with a light oil, such as WD-40, and run your drill at a low speed. To drill a 1/4" hole, for example, use a speed of about 1,800 rpm; for a 1/2" hole, set the speed at 900 rpm. These steps prevent heat build-up that can melt the plastic.

Bond with solvent

Check at hardware stores, home centers, or specialized plastics outlets (look under "Plastics" in the Yellow Pages) for methelyne-chloride solvent, labled as a cement for acrylics. It bonds acrylic to itself or polycarbonate to itself by dissolving a thin layer of plastic on the adjoining surfaces. The plastic flows together and hardens to make a joint.



Plastic can shatter or climb the bit when you use a standard twist bit. Grind your bit to turn it into a rotary scraper, and you can put clean holes right near the edge of a piece.

When joining an edge to a face, make the edge smooth and straight. As shown in the photo *opposite*, rest one piece on the other, with a backer board behind each, and clamp in place. Keep the vertical backer board separated from the joint line so it doesn't contact the solvent.

Use a solvent applicator, like the long-needled model shown, or a syringe to place a small amount of solvent all along the joint. It will flow between the pieces, dissolving plastic as it goes.

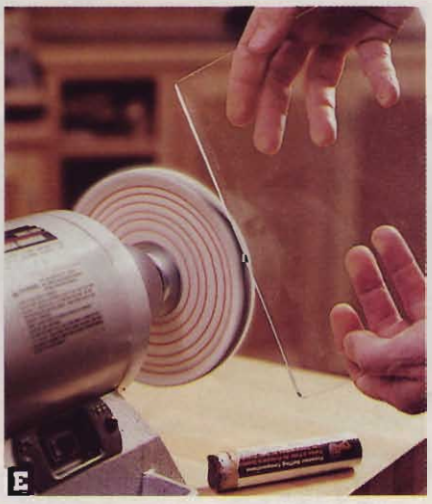
You can handle the assembly after it has hardened for several minutes, but the bond continues to get stronger for about a week. We left a small tongue protruding, as you can see in the photo, then shaved it off later with a bearing-piloted flush-trim bit in a router table.

Smooth and polish

If you're making a quick jig for the shop, the edges that you saw, joint, or rout should be satisfactory as they are. But if you want a more finished look for a display piece, you easily can smooth and even polish the edges.

Smooth it to a matte finish with a hand scraper. To refine it further, use a sanding block and fine, wet/dry sandpaper, starting with 320 grit and moving up through finer grits until you're satisfied with the appearance. For total clarity, charge a buffing wheel with a tripoli buffing compound, and polish the edge as shown in **Photo E.**

Flush-trim router bits work great with plastic. Here we're shaping a router table insert plate from phenolic laminate.

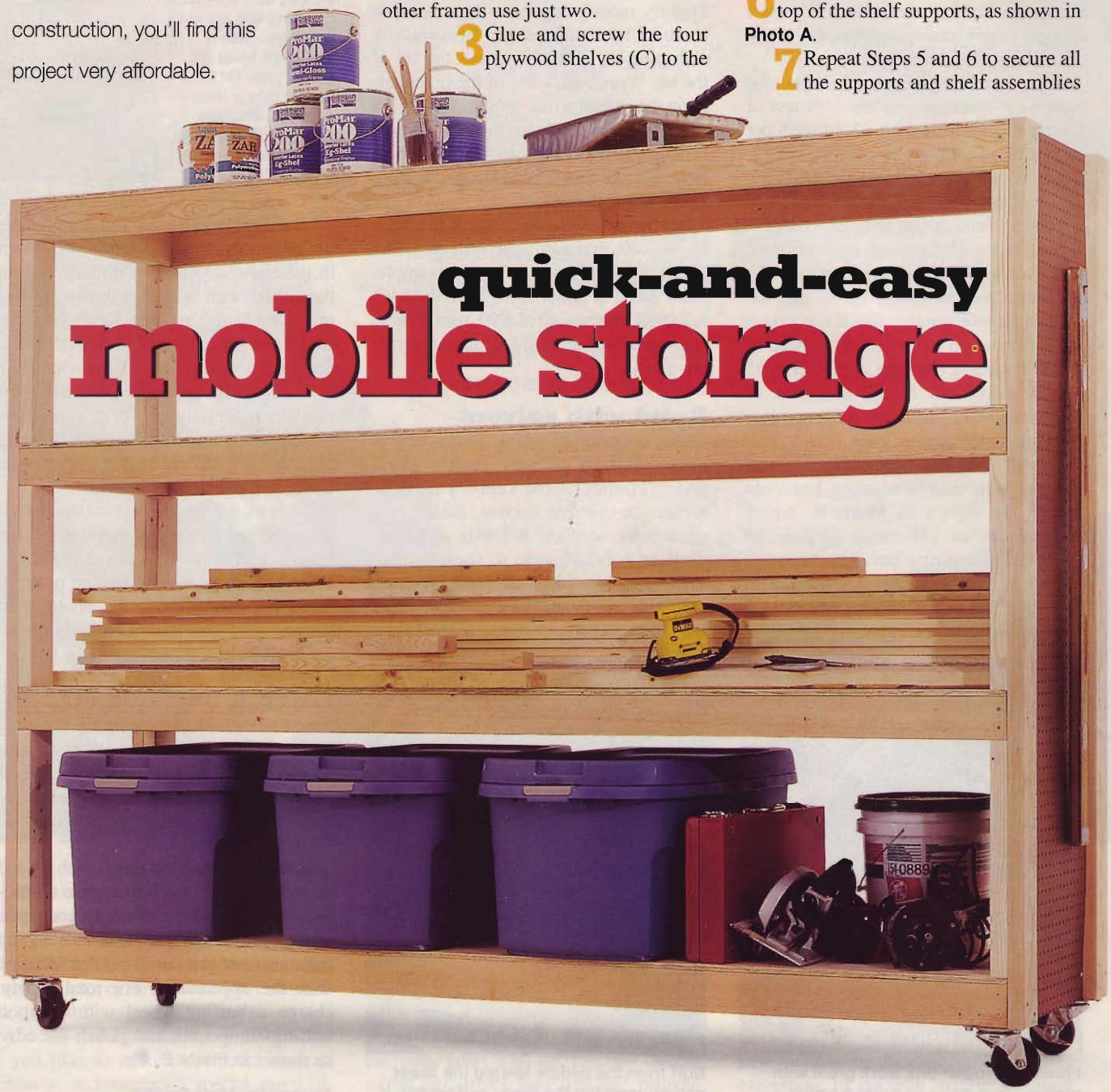


Buff from the middle toward the lower corner, then flip the piece and repeat. If you work the top corner, it could catch.

Photographs: **Marty Baldwin; Hetherington Photography**

quick-and-easy mobile storage

Just like clamps, you never seem to have enough storage. And this easily built project will serve your needs in spades. Use it for lumber storage in the shop or as a catchall in the garage or basement. Plus, using 1/2" plywood and 2x4s for its construction, you'll find this project very affordable.



***Note:** Our unit measures 99" long and rests on four casters for mobility. Size the unit to suit your needs and omit the casters if mobility is not a requirement.*

1 Cut the 2×4, plywood, and perforated hardboard parts A,B,C,D,E,F to the sizes listed in the Materials List.

2 On a flat surface drill countersunk mounting holes, and screw the shelf supports (A, B) together to form four rectangular 2×4 frames. Note that the bottom frame uses four Bs and the other frames use just two.

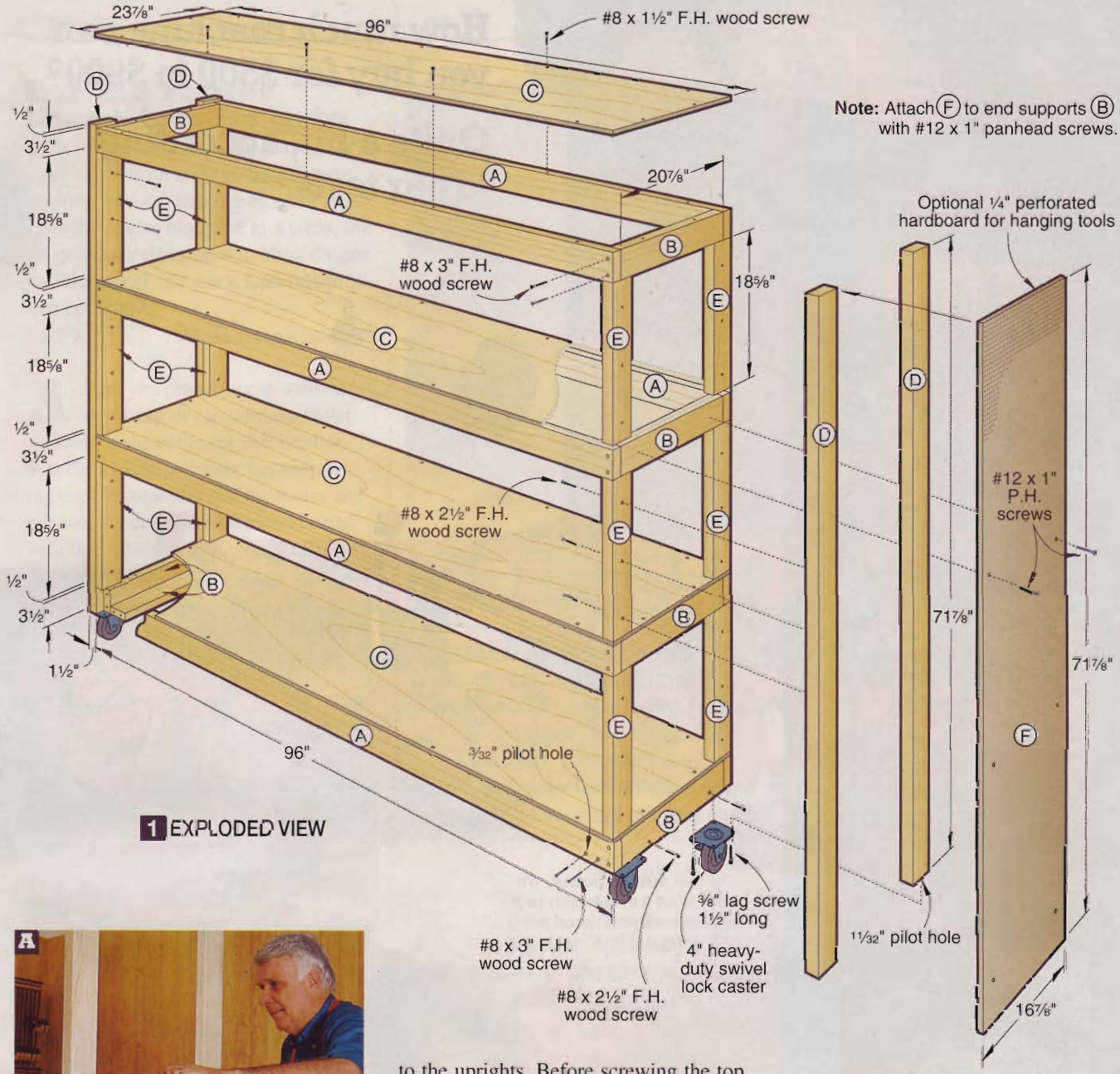
3 Glue and screw the four plywood shelves (C) to the 2×4 frames. Check each for square. Sand or rout slight round-overs to break the sharp edges along the top edges of the ½" plywood shelves.

4 Glue and screw the four uprights (D) to what will be the bottom shelf assembly (A, B, C). Use a framing square to ensure squareness and plumb of the uprights to the shelf assembly.

5 Screw the bottom four vertical supports (E) to the inside faces of the uprights (D).

6 Position the next shelf assembly on top of the shelf supports, as shown in **Photo A.**

7 Repeat Steps 5 and 6 to secure all the supports and shelf assemblies


23⅞"
96"
#8 x 1½" F.H. wood screw
Note: Attach (F) to end supports (B) with #12 x 1" panhead screws.
20⅞"
Optional ¼" perforated hardboard for hanging tools
#8 x 3" F.H. wood screw
#8 x 2½" F.H. wood screw
#12 x 1" P.H. screws
71⅞"
96"
3/32" pilot hole
3/8" lag screw 1½" long
#8 x 3" F.H. wood screw
4" heavy-duty swivel lock caster
#8 x 2½" F.H. wood screw
11/32" pilot hole
16⅞"

1 EXPLODED VIEW

One level at a time, glue and screw the 2x4 vertical supports into position, and add a shelf assembly. Continue the process to the top of the project.

to the uprights. Before screwing the top four supports (E) in place, make sure the top of the top shelf sits flush with the top ends of the uprights (D). Trim the top four vertical supports if necessary.

8 Cut the perforated hardboard (F) to fit between two uprights for additional storage on one or both ends of the unit. Add hooks for hanging tools, accessories, or supplies.

9 Lay the unit on its side and attach 4" heavy-duty swivel-lock casters to the bottom if desired. Paint the completed project if desired.

Project design: **Charles I. Hedlund**
Photographs: **Baldwin Photography**
Illustration: **Roxanne LeMoine; Lorna Johnson**

materials list

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	horiz. front & back supports	1½"	3½"	96"	C	8
B	end supports	1½"	3½"	20⅞"	C	10
C	shelves	½"	23⅞"	96"	PL	4
D	uprights	1½"	3½"	71⅞"	C	4
E	vertical supports	1½"	3½"	18⅝"	C	12
F	end panel	¼"	16⅞"	71⅞"	PH	1

Materials Key: C–choice of pine or fir 2x4, PL–plywood, PH–perforated hardboard.

Supplies: ⅜" lag screws 1½" long (16), 4" heavy-duty swivel-lock casters (4), #12x1" panhead screws, #8x3" flathead wood screws, #8x2½" flathead wood screws, #8x1½" flathead wood screws.

How much machine can you buy for $500 to $900?

Quite a bit, according to our tests.

7 mid-priced bandsaws

To test cutting power, we mounted a stopwatch to a pushblock and timed a 12"-long cut in 6"-wide red oak.

READERS' TOP 5

We surveyed woodworkers at www.woodonline.com to find out what matters most in a bandsaw. They told us:

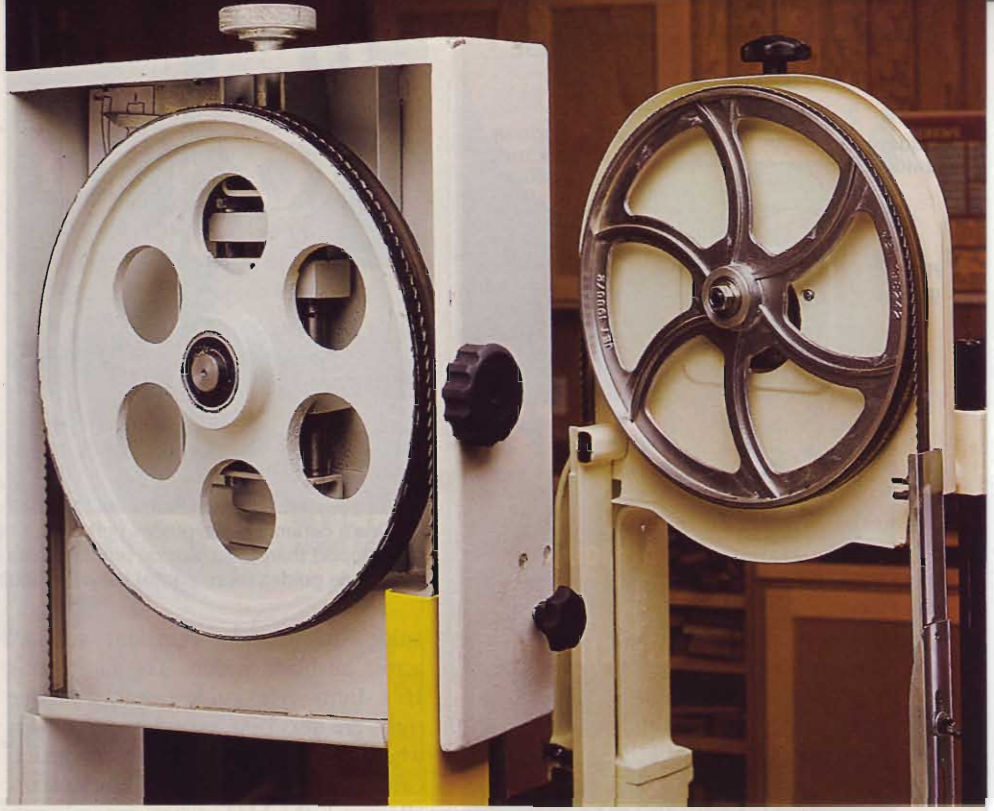
1. ***Power***
2. ***Resawing capacity***
3. ***Blade-guide system***
4. ***Blade-changing ease***
5. ***Table adjustments***

We'll take a close look at each area in this article.

The bandsaws in this test meet the requirements of most home woodworkers: Their throat (ripping) capacities range from 13¼" to 16½"; all have enough power to handle most resawing tasks; and all but one of the models can be wired to a 110- or 220-volt power supply.

Our first testing step was to assemble and align the tools, according to the tune-up procedure described on *page 80*, and make note of any problems out of the box. Using new 3-teeth-per-inch (tpi) Lenox carbon-steel blades in each saw, tensioned identically, we resawed 6"-wide red oak, pushing each saw hard, but not to the point of stalling. We averaged the results of three tests, as described at *left* and shown in the Plowing Power chart *below*.

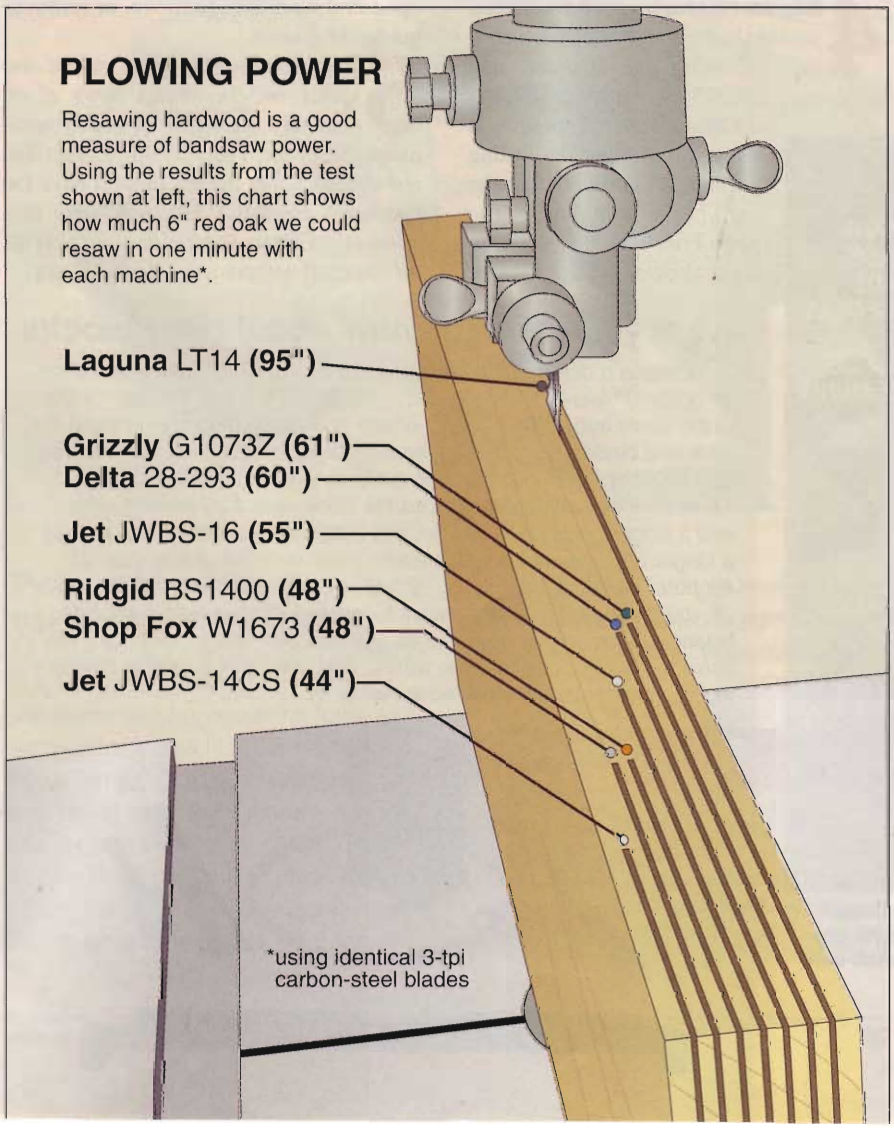
Next, we resawed the widest piece of red oak that would fit on each saw. (We installed riser blocks on the three saws that offer them as an option. See "What you need to know about riser blocks" on *page 76*.) With some patience, all of the saws could resaw their maximum.



The Laguna LT14's heavy cast-iron wheels (left) act like flywheels to muscle the blade through hard woods and difficult cuts faster than the typical cast-aluminum, spoked wheels (right).

PLOWING POWER

Resawing hardwood is a good measure of bandsaw power. Using the results from the test shown at left, this chart shows how much 6" red oak we could resaw in one minute with each machine*.

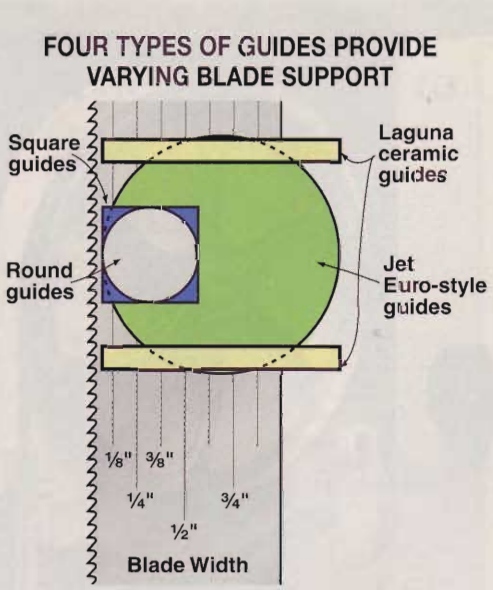


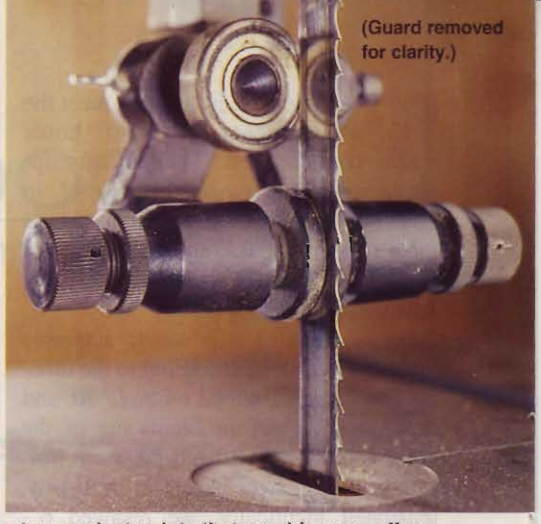
The top five bandsaw buying points

1 Power. The manufacturer-rated horsepower of the tested saws ranges from ¾ hp to 2 hp, but those ratings don't necessarily match up with true cutting power. For example, the Laguna LT14 has only a ½-hp advantage over the Jet JWBS-14CS, but the LT14 cut more than twice as fast in our 6" resaw test. (See the chart at *left*.) In addition to its stout, 220-volt-only motor, the momentum of the LT14's massive cast-iron wheels, shown *above*, carry the blade through tough cuts without bogging down.

2 Resawing capacity. Two factors contribute to a bandsaw's resawing capacity: the distance between the table and the fully raised blade guides, and power. Maximum resawing capacity for the tested saws ranged from 6" to 12¼". (See the chart on *pages 78-79*.) Even with riser-blocks installed, we could resaw 12"-wide red-oak stock at an acceptable rate for home woodworking (about 12" per minute). If you work under production conditions that require faster resaw speeds in wide stock, you may need a more powerful bandsaw than those we tested.

3 Blade-guide system. Guide blocks keep the blade from twisting and deflecting left or right, and a thrust bearing backs up the blade to keep





Laguna's ceramic blade guides (left photo) have two contact points that provide more effective support than solid blocks, but have less surface area so they run cooler. Disc-shaped Euro-style guides (right photo) keep the blade on the straight and narrow on the Jet JWBS-16.

it from bending back while you cut. (See photo, *below*.) Both must be set precisely for optimal performance, and micro-adjustment knobs simplify the process. We gave high marks to those saws that have such adjusters. If the lower adjusters under the table are located in a tight spot, we downgraded the rating slightly.

As for the guide blocks themselves, the drawing and photo *above*, show how Laguna's ceramic guide blocks contact the blade at eight points—four on the upper guide and four on the lower guide—to provide excellent support across all blade widths. The Jet JWBS-16's Euro-style guides, shown *above right*, are next best, except on ⅛" blades where square guides make better contact. Graphite-impregnated guide blocks actually touch the blade when properly set, but self-lubricate to keep the blade cool and prevent wear.

4 Blade-changing ease. Here, we rated all aspects of blade changing: releasing the tension, and removing, reinstalling, and retensioning the blade. None of the saws in our test have knuckle-busting tensioning knobs: all clear the top wheel housing easily. The Shop Fox W1673 has a nifty lever, shown on *page 79*, that relaxes blade tension instantly. It's not enough to remove the blade, but it eliminates much of the cranking required by the other saws.

We prefer to use as few tools as possible when swapping blades, and the Jet JWBS-14CS and Ridgid saws rank high here, requiring only a Phillips screwdriver. Some need hexhead wrenches and/or open-end wrenches to move, or remove, guides or guards.

5 Table adjustments. All of the tables on the tested saws pivot smoothly on a pair of sturdy trunnions. All of them also tilt 45° to the right and at least 10° to the left (a must-have for bandsawn dovetails). However, only two saws—the Grizzly and Laguna—let you tilt the table left without resetting the 0° stop.

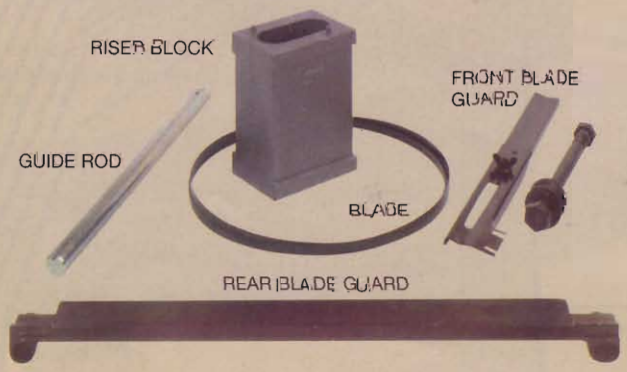
A micro-adjustment knob, like this one on the Delta, moves the thrust bearing forward or backward for precise positioning behind the blade. The lower knob controls the location of the guide blocks.

what you need to know about riser blocks

To increase a bandsaw's resawing capacity, some manufacturers offer an optional "riser-block"—a cast-iron block that you bolt into the middle of the saw's frame. The extra 4–6" can double the distance between the table and blade guides, adding enough capacity to make book-matched 22"- to 26"-wide panels, or rough out a deep bowl blank for turning.

A riser-block kit typically includes the block, extended blade guards, and a longer guide post. The Jet and Ridgid kits we tested also include a longer 6-tpi, general-purpose blade. Installation takes less than 30 minutes with a helper.

If you think you'll eventually want a riser block for your saw, consider buying a kit when you buy the saw. (It'll add $60–$90 to the price.) We know many woodworkers who waited, and now have bandsaw blades too short for their riser-block equipped saws.



meet the bandsaws in our test

Delta 28-293, $780, www.deltamachinery.com, 800/438-2486

(shown with optional riser-block kit)

With no thumbscrews for the blade guides, the Delta 28-293 provides a clear view to the cut line.

High points

- Virtually tied as second fastest-cutting bandsaw in the test.
- Lower blade guides are close to underside of table for outstanding support and reduced blade deflection.
- Micro-adjustment knobs for lower blade guides access easily from the front of the table.

Low points

- Guide post can drop when loosened unless supported.
- Thumbscrew to adjust tracking is small and uncomfortable to use.

More points

- Although you need a hexhead wrench to secure guide blocks, the set screws provide an unobstructed view of blade. (See photo at *left*.)
- In late June, Delta introduced the 28-241, an updated version of the 28-293 we tested. According to a Delta official, they've boosted the power to 1½ hp and fixed the guide-post problem. The new model will sell for about $700, and also comes in an open-stand version (model 28-231) costing $625.

Jet JWBS-14CS, $600, www.jettools.com, 800/274-6848

(shown with optional riser-block kit)

High points

- No tools required for frequent adjustments; changing blades requires only a Phillips screwdriver to remove rear blade guard.

Low points

- When resawing, the 1-hp motor struggled to maintain constant speed unless we backed off the feed pressure.

More points

- The JWBS-14OS is identical, except it has a ¾-hp motor and open stand. It sells for $530.

Grizzly G1073Z, $695, www.grizzly.com, 800/523-4777

High points

- Virtually tied as second fastest-cutting bandsaw in the test.
- The large table tilts left without resetting 0° stop.
- Price includes a good-quality rip fence and miter gauge.

Low points

- To remove the rip fence, you must disassemble one end of the front fence rail.
- The thin drive belt slipped off the pulleys twice during our testing.
- Rubber feet helped dampen vibration, but set the machine swaying during heavy cuts.

More points

- At 408 pounds, it's heavy! You'll need a strong friend (or two) to help you mount the saw to its base.
- Open-stand version (G1073) sells for $625.
- This machine has three blade speeds, but we found no advantage to the lower speeds.

New bandsaws due in October

Just as this issue went to press, officials from Delta and Grizzly told us of new mid-priced bandsaws they're bringing to the market. Delta announced a new line of Asian-made saws modeled after the USA-made saws, described at *left*, that also include a quick-release blade tensioner and a 4" dust-collection port. The open-stand, ¾-hp 28-276 sells for around $400; the closed-stand,1-hp 28-206 runs about $600.

Meanwhile, Grizzly introduced two new mid-priced saws, the 14" G0555 and the 17" G0513 (shown at *right*). Both offer ball-bearing blade guides, extruded aluminum fences, and miter gauges as standard equipment. Like Delta's new models, they too sport quick-release blade tensioners and 4" dust ports.

The riser-block-ready, 1-hp G0555 will sell for $375, and the 2-hp, dual-voltage, G0513 will go for $750. (Prices do not include shipping where applicable.)

Grizzly G0555

Grizzly G0513

Jet JWBS-16, $800, www.jettools.com, 800/274-6848

High points

- Its 10" resawing capacity is the largest in the test without going to a riser-block equipped model.
- The rack-and-pinion guide post has a scale for no-fail setting of guide height.
- Offers excellent dust collection, including the only 4" dust port in the test. (Others range from 2¼" to 3⅛".)
- Euro-style blade guides provide good support for blades ¼" or wider.

Low points

- Upper blade guides have micro-adjust knobs, but lower guides don't.
- Access to lower blade-guide assembly is rather tight.
- Wraparound blade guard limits line-of-sight to the blade and cutline.

More points

- Tension adjustment is easy to reach, owing to its location below the top wheel housing, but we needed two hands to turn it because of the size of the adjustment wheel.
- The model we tested was a pre-production sample; Jet officials expect the saw will be available later this fall.

Laguna LT14, $895, www.lagunatools.com, 800/234-1976

High points

- The LT14 cut 50 percent faster than the next fastest tested saws.
- The large throat plate has leveling screws (similar to some tablesaws) for flushing the throat plate to the tabletop.
- Table tilts 15° left without having to reset 0° stop.
- Four-point ceramic blade guides (see photo on *page 76*) offer excellent support for all blade widths.

Low points

- Adjusting blade guides and bearings requires three different sizes of hexhead wrenches, slowing blade changes.

More points

- The motor requires 220-volt electrical service.
- A high-quality fence comes with this saw, but removing it requires partial disassembly of front fence rail.
- After we made an adapter for the unusually sized port (3⅛"), the dust collection effectiveness was excellent.
- If you're buying a bandsaw for resawing, the LT14 is by far the best of the bunch.

Ridgid BS1400, $500, www.ridgidwoodworking.com, 800/474-3443

(shown with optional riser-block kit)

High points

- All adjustment knobs and screws have a comfortable soft-grip coating.
- Up-front scale eases setting table angle.
- At $500, it's the least-expensive saw we tested, and a good value.

Low points

- We couldn't push this saw very hard and get good results. It took several cuts before we found the right feed pressure for the fastest resawing.

More points

- It comes with a narrow sanding belt and platen to turn your bandsaw into a strip sander.

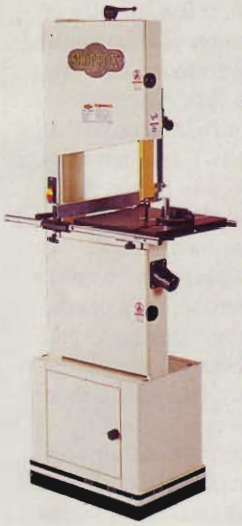
HOW THE

BRAND	MODEL	VOLTAGE (1)	MOTOR: RATED HORSEPOWER	MOTOR: BLADE SPEED(S) (FEET PER MINUTE)	CAPACITY (INCHES): RIPPING (2)	CAPACITY (INCHES): RESAWING (3)	CAPACITY (INCHES): RESAWING WITH RISER BLOCK INSTALLED (3)
DELTA	28-293	110/220	1	3,000	13¾	6¼	12¼
GRIZZLY	G1073Z	110/220*	2	2,275 2,720 3,625	16½	7⅜	N/A
JET	JWBS-14CS	110/220	1	3,000	13½	6	12
	JWBS-16	110/220	1	3,000	16¼	10	N/A
LAGUNA	LT14	220	1½	3,500	13¼	8⅝	N/A
RIDGID	BS1400	110/220	¾	2,800	13⅝	6	12
SHOP FOX	W1673	110/220	1½	2,300 3,300	15¾	8⅝	N/A

NOTES:

1. Dual-voltage machines pre-wired for 110 volts unless otherwise noted. * Comes pre-wired for 220 volts.
2. Distance between blade and frame.
3. Distance between table and fully-raised blade guard.
4. (*) 0° table stop must be reset to tilt table left.
5. (C) Ceramic
   (E) Euro-style
   (GP) Graphite-impregnated plastic
   (RS) Round steel
   (SS) Square steel

Shop Fox W1673, $895, www.shopfox.biz, 800/840-8420



High points

- Tension lever (shown at *right*) releases or applies blade tension with a flick of the wrist.
- Rip fence and miter gauge come standard.

Low points

- Motor is hard to mount to closed base; an extra set of hands to thread nuts on bolts is helpful.
- It's the only tested saw that won't accept a ⅛" blade.

More points

- A middle-of-the-pack performer for a premium price.
- The Shop Fox W1672 is a downsized clone of this machine with a 1-hp motor, 14" rip capacity, and 7⅜" resaw capacity. It sells for $595.
- This machine has two blade speeds, but we found no advantage to the lower speed.

Shop Fox's tension lever rotates to adjust blade tension, then flips up to relax the tension for extended blade life.

Choose the saw by how you'll use it

In this price range you won't find a bandsaw with more cutting power than the Laguna LT14, so it's our first choice for a resawing machine. It does, however, require 220-volt service. The Delta 28-293 isn't as powerful as the Laguna, but it's more user-friendly, runs on 110 volts, and costs about $115 less. If those machines make your pocketbook pucker and you don't plan to do a lot of resawing, Ridgid's BS1400 is an excellent value at $500.

Written by **Dave Campbell** with **Jeff Hall**
Photographs: **Marty Baldwin** Illustration: **Tim Cahill**

Talk about these tools in our special bandsaws forum, or find specifications on other types of tools, by clicking on the "Tool Comparisons" tab at www.woodmall.com.

TESTED BANDSAWS GRADE OUT

	BLADE		TABLE			GUIDES			PERFORMANCE REPORT CARD (7)											ACCESSORIES (9)					
LENGTH (INCHES)	MINIMUM / MAXIMUM BLADE WIDTH (INCHES)	SIZE (INCHES)	TILT RANGE (RIGHT / LEFT, DEGREES) (4)	HEIGHT FROM FLOOR (INCHES)	STYLE / MATERIAL (5)	MICRO-ADJUSTABLE GUIDES (YES/NO)	DUST PORT DIAMETER (INCHES) (6)	EASE OF ASSEMBLY	POWER	EASE OF ADJUSTING BLADE GUIDES	EASE OF ADJUSTING BLADE TENSION	EASE OF CHANGING BLADES	TABLE ADJUSTMENTS	VIBRATION	DUST COLLECTION EFFECTIVENESS	LINE OF SIGHT TO BLADE	NOISE LEVEL (dB) (8)	STANDARD	OPTIONAL	WARRANTY (10)	COUNTRY OF ASSEMBLY (11)	WEIGHT (POUNDS)	SELLING PRICE (12)
93½	⅛-¾	14x14	45/10*	42¾	SS	Y	2¼	A-	A-	A-	A-	B+	B+	A-	B+	A	77/96		B,C,F,L,M,R	2 yrs.	U	224	$780
113	⅛-1	17x17	45/10	42¾	RS	Y	2¼	B+	A-	A-	B+	A-	A	B-	B+	B	75/103	F,M	B,BG,FG,L	1 yr.	T	408	695
93½	⅛-¾	15x15	45/10*	43¾	GP	Y	2¼	A-	B-	A-	A-	A-	B+	A-	B+	B	76/97		B,BG,F,FG, L,M,R,SK	2 yrs.	T	185	600
123	⅛-1¼	17x17	45/15*	39½	E	N	4	A	B+	C-	B+	B	B-	A-	A	C	67/92		B,BG,F,L,M	2 yrs.	T	285	800
105	⅛-1	15x15	45/15	44	C	N	3⅛	A-	A	C-	A-	B-	A	A	A-	A	80/96	F	M	1 yr.	B	230	895
93½	⅛-¾	14x14	45/10*	44½	SS	Y	2¼	B-	B	B	A-	B	B+	A	B+	B	75/88	SB	B,F,M,R	LIFE	C	185	500
115	¼-1¼	16x16	45/10*	42¾	GP	N	2¼	B	B	B+	A	A-	B+	B+	B+	B	73/91	F,M	B,BG	2 yrs.	T	335	895

NOTES:

6. 2¼" port fits standard 2½" vacuum hose.

7. A Excellent
   B Good
   C Average

8. First measurement is saw under no load. Second measurement is while resawing red oak.

9. (B) Mobile base
   (BG) Ball-bearing guides
   (C) Circle-cutting jig
   (F) Fence
   (FG) Fiber guides
   (L) Light
   (M) Miter gauge
   (R) Riser-block kit
   (SB) Sanding belt and platen
   (SK) Three-speed kit

10. (LIFE) Lifetime warranty against factory defects.

11. (B) Belgium
    (C) China
    (T) Taiwan
    (U) United States

12. Prices current at time of article's production, and do not include shipping where applicable.

10-step tool tune-up: bandsaws

On some bandsaws, the wheels are too deep in the wheel housings to use a straightedge to align them. We modified a straight piece of wood to reach inside the housings.

Just as with your car, a few minutes of regular maintenance on your bandsaw can save you time and money over the long haul. The next time you change blades on your saw (or right after you've assembled your new saw), take ten minutes to ensure your tool's in tip-top shape and running true. Here's how.

1 Unplug the saw, then remove the blade as you normally would: Release blade tension, back out the blade guides and thrust bearings, and remove guards if necessary. Remove the guide blocks, and clean and square their contact surfaces, if necessary.

2 Clean the wheels. No matter how effective the machine's dust collection, some debris always gets mashed between the blade and tire. Hold 100-grit sandpaper against the surface of the tire and rotate the wheel by hand until the tire is residue-free. Brush or vacuum accumulated dust from inside the wheel housings.

3 Install and tension the blade. If the blade is brand new, first wipe it with a paper towel or cloth to remove any oil. Although most bandsaws have a tension indicator, we've always had better luck tensioning by hand (or by ear—more on that in a moment). With the upper guard 6" above the tabletop and the guide blocks reinstalled, push on the side of the blade with your pinky finger about 3" above the table. If the blade deflects more than ¼" under moderate pressure, add more tension.

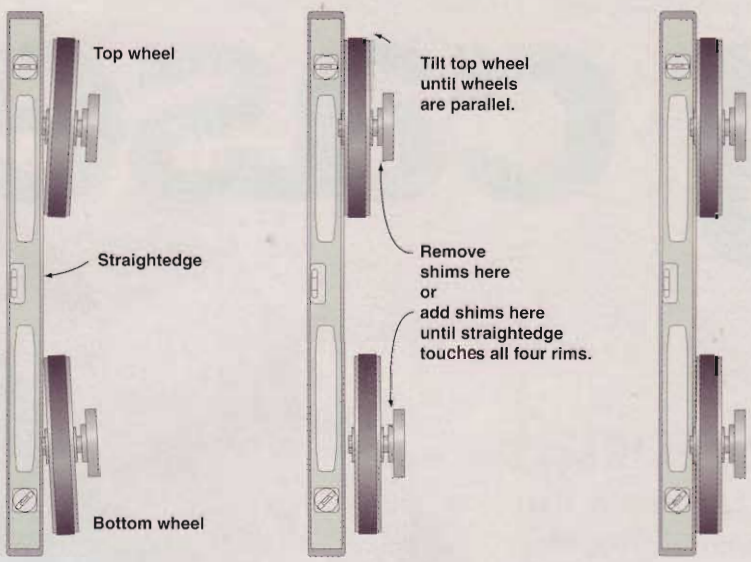
Some woodworkers pluck the bandsaw blade like a guitar string to set the tension. To do this, increase tension and keep plucking until the tone turns from a dull buzz into a clear tone. If the tone begins to deaden again, you've overtensioned the blade: Back it off until the blade sings again.

Once satisfied with the tension, make an index mark somewhere on the blade-tensioning mechanism. You want to be able to return to the same tension while you continue with your tune-up.

(By the way, any time you don't plan to use the saw for a few days, relax the blade tension. That will help extend the life of the wheels and wheel bearings.)

4 Align the wheels. It's not enough for the wheels to be parallel; they must also be on the same plane, a condition called "coplaner." To make them so, begin by removing the table from your saw (or at least tilting it as far

ALIGNING BANDSAW WHEELS


Top wheel
Straightedge
Bottom wheel
Tilt top wheel until wheels are parallel.
Remove shims here or add shims here until straightedge touches all four rims.

WHEELS NOT COPLANER OR PARALLEL | WHEELS PARALLEL, BUT NOT COPLANER | WHEELS COPLANER

right as it will go.) Open or remove the wheel covers and lay a long straightedge against the rims of the wheels, as shown *above* or in the photo *opposite*, staying as close to the hubs as you can. If the straightedge touches all four edges of the wheel rims, skip to **Step 7**. If not, you'll need to align the wheels, as described in **Steps 5–6**.

5 Start by making the wheels parallel. With the straightedge against both wheels as in **Step 4**, tilt the top wheel until the straightedge contacts both rims of either wheel. (Follow the manufacturer's instructions for this adjustment.) Maintaining contact with that wheel, keep tilting the top wheel until the gap between the straightedge and the other wheel is parallel.

6 If the straightedge isn't touching all four rims at this point, you'll need to move one wheel in or out the distance of the gap. Again, follow the manufacturer's instructions for this adjustment. Some bandsaws require adding or removing shims behind the wheel to make them coplaner. Ordinary washers work fine for these shims, or make your own from sheet metal. If you had to remove the blade to shim the wheels, reinstall and retension it.

7 Now it's time to check the blade tracking. If you've done everything properly so far, little adjustment should be needed. Rotate the top wheel by hand, watching the blade's position on the tire surface. If the blade works its way to one edge or the other, tweak the wheel-tilt slightly until it travels true. Don't worry about keeping the blade dead-center in the tire; it should just find a line and stick to it. Replace or close and secure the wheel covers.

8 Got a dollar? It's the cheapest feeler gauge you'll find. Fold the bill, place it between the upper thrust bearing and the back edge of the blade, as shown in the **Photo A**, and adjust the bearing location until it just holds the bill in place. Secure the bearing, and repeat for the lower thrust bearing.

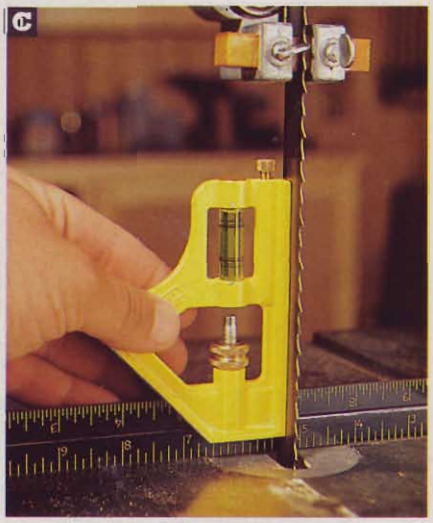
9 Position the upper guide-block assembly so that the front edge of the blocks are just a whisker behind the blade's gullets (the valleys between the teeth). Repeat for the lower guide-block assembly.

Place one thickness of your dollar-bill feeler gauge between the upper left guide block and the blade, and adjust the block so that it pinches the bill between block and blade without deflecting the blade. Secure the left block. With the bill still in place on the left, thread the other end between the right block and the blade, snug the right block up against the bill and blade (as shown in **Photo B**), and lock it into place. Now, repeat this process for the lower guide blocks.

10 Reinstall the table. Raise the upper blade-guide assembly as high as it will go, and use a drafting triangle or combination square to ensure the table is perpendicular to the blade, as shown in **Photo C**. If not, adjust the table's 0° stop (usually a bolt under the table) in or out until it is.

A double thickness of paper currency provides proper clearance between the thrust bearing and the back edge of the blade.

A dollar bill wrapped around the blade helps set the saw's guide blocks.



With the bandsaw table's 0° stop set precisely, you're ready to begin cutting.

flag case

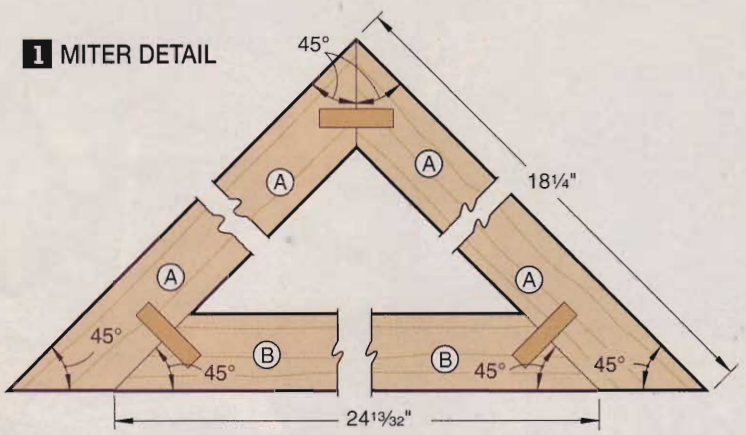
A hero's memorial

Designed for a 5x9½' American flag, this case preserves the carefully-folded symbol of our nation and honors the memory of a loved one. You can set this case on a tabletop or shelf, or hang it on a wall courtesy of a clever pair of bevel-edge cleats.

Making a flag case usually requires cutting long, narrow 22½° miters where the sides meet the base. By fitting the base between the sides, our design eliminates these difficult cuts, leaving you with easy 45° miters all around.

For the items needed to build this project, see the Materials List and Cutting Diagram on *page 85*.

1 MITER DETAIL



First, make the triangular frame

1 Plane a ¾×4×72" board to ½" thick for the sides (A) and the base (B). Cut these parts to the width and about 1" longer than the lengths listed in the Materials List. Save the extra stock for testing the spline-kerf cuts later. Take care to plane your material accurately. It must be exactly ½" thick for all the frame dimensions to work.

2 Miter-cut parts A and B to length, to the dimensions shown on **Drawing 1**. Note that all the miters cuts are 45° and that the base fits between the sides. Miter the ends of your test piece for use later when setting up your tablesaw to cut the spline kerfs in the sides (A).

3 Referring to the three steps shown at *right*, cut the spline kerfs in the mitered ends of parts A and B. Use your test piece to verify the accuracy of your saw setups before cutting the kerfs in the parts.

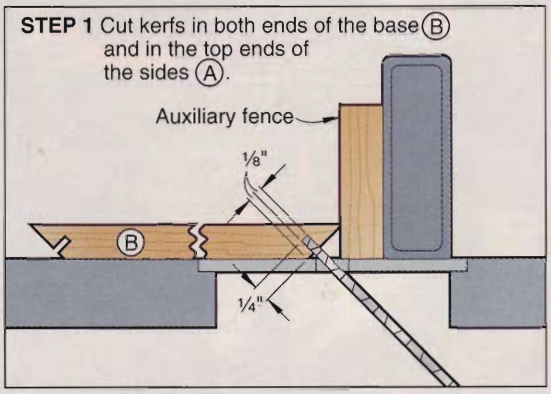
4 Rip a 7⁄16×12" strip of ⅛" hardboard, then crosscut three 3⅜"-long splines. Test the fit of the splines in the kerfs. We had to lightly sand our splines for a good fit. Dry-assemble the sides and base with the splines to check the fit, then apply glue to the miters and splines, and clamp the frame together, as shown in **Photo A**.

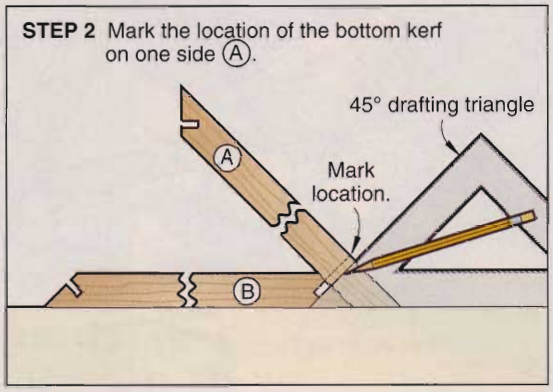
Add the trim, back, glass, and liners

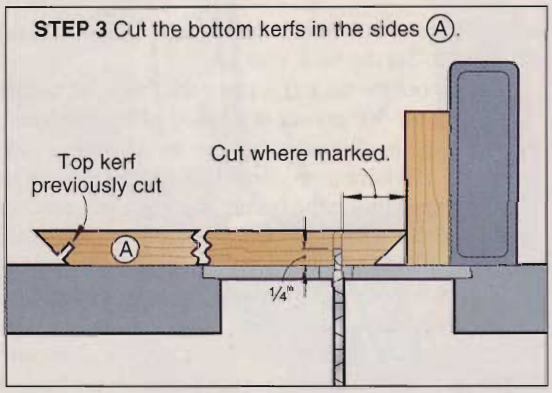
1 From the edge of a ¾"-thick, 25"-long board, rip six ½"-wide strips for the side trim (C) and base trim (D). Laying the strips on their ¾" faces, plane them to ⅜" thick. Miter-cut two sets of trim to length, one set each for the frame's front and back. The trim miters match those of the frame. The outside edges of the trim and frame are flush, as shown on **Drawing 2**.

2 Glue and clamp one set of trim (C, D) to the frame's front edge. With the glue dry, clamp (do not glue) the other set to the frame's back edge,

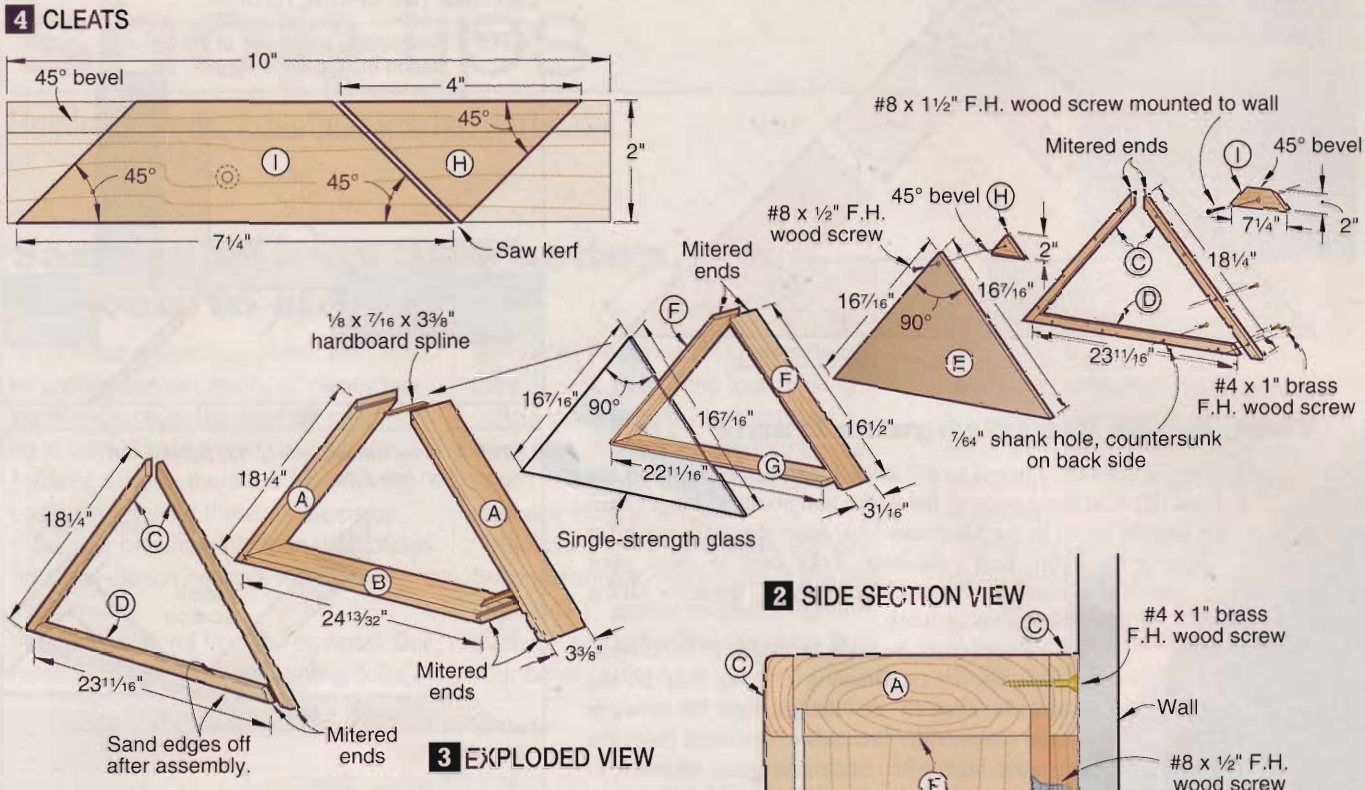
CUTTING THE SPLINE KERFS







Set the assembled frame on a flat surface, and draw its mitered corners together with a pair of bandclamps.



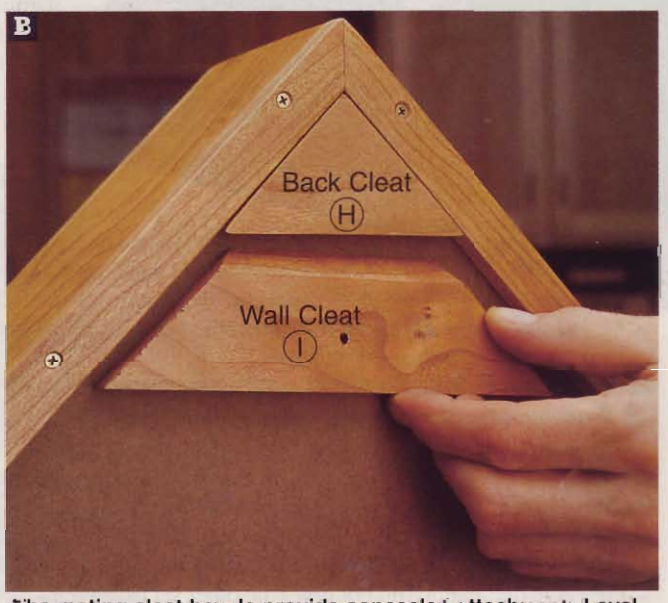
and drill pilot and countersunk shank holes, where shown on **Drawing 3**. Set the back trim aside.

3 To lay out the back (E), place the frame's back top 90° corner on the 90° corner of a piece of ¼" hardboard. Trace a line onto the hardboard along the inside edge of the base (B). Bandsaw and joint to the line. Have a piece of single-strength glass cut to fit inside the frame, leaving a 1⁄16" space all around. (You also can use clear acrylic sheet, and cut it with an 80-tooth carbide-tipped blade.)

4 Resaw a ¾×3¼×36" board in half, and plane it to ¼" thick for the side liners (F) and base liner (G). Cut these parts about ⅛" wider and ½" longer than the dimensions listed. Miter-cut the parts to fit inside the frame. The fit should be snug, but not tight. To determine the exact width for the liners, place the frame facedown on your bench, and lay in the glass and back. Slide the liners into the frame, and mark their finished width by striking a line even with the back edges of the frame. Remove the liners, and trim them to width.

5 Plane a ¾×2×10" board to ⅜" thick to make a blank for the back cleat (H) and wall cleat (I). Make a 45° bevel rip along one edge, where shown on **Drawing 4**. Cut parts H and I from the blank where dimentioned. Drill a countersunk hole in the wall cleat (I) for attachment to the wall later.

6 Assemble the glass, liners (F, G), and back (E) in the frame. Screw the back side trim (C) in place. Glue and clamp the back cleat (H) to the back with its 90° corner nested in the corner formed by the trim, and the bevel oriented as shown on **Drawing 2**. With the glue dry, remove the back, drill a pilot and countersunk shank hole in the back and cleat, and drive in the screw.



The mating cleat bevels provide concealed attachment. Level the wall cleat during installation to ensure a level-hanging case.

Apply finish and assemble the case

1 Remove the liners and glass. Sand all the parts, except the back, to 220 grit. Ease any sharp edges with a sanding block. Apply two coats of satin polyurethane, sanding lightly with 220-grit sandpaper between coats.

2 With the finish dry, lay the frame facedown on your workbench. Place the glass in the frame, insert the liners, then the folded flag. Add the back, and screw the rear side and base trim (C, D) in place. If you need to fold your flag to fit the case, see the sidebar, "The correct way to fold the American flag" at *right*.

3 Fasten the wall cleat (I) to the wall, either screwing into a wall stud, or using a wall anchor. Check the cleat for level. Hang the case. Note how the back cleat (H) and the wall cleat (I) interlock in **Photo B** and on **Drawing 2**.

materials list

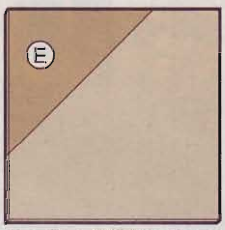
Part	FINISHED SIZE T	W	L	Matl.	Qty.
A* sides	½"	3⅜"	18¼"	C	2
B* base	½"	3⅜"	24 13/32"	C	1
C* side trim	⅜"	¾"	18¼"	C	4
D* base trim	⅜"	¾"	23 11/16"	C	2
E back	¼"	16 7/16"	16 7/16"	H	1
F* side liners	¼"	3 1/16"	16½"	C	2
G* base liner	¼"	3 1/16"	22 11/16"	C	1
H* back cleat	⅜"	2"	4"	C	1
I* wall cleat	⅜"	2"	7¼"	C	1

*Parts initially cut oversize. See the instructions.

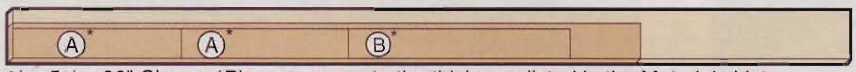
Materials Key: C–cherry, H–hardboard.

Supplies: ⅛" hardboard, #4x1" brass flathead wood screws (12), #8x1½" flathead wood screw, #8x1½" flathead wood screw, wall anchor, single-strength glass.

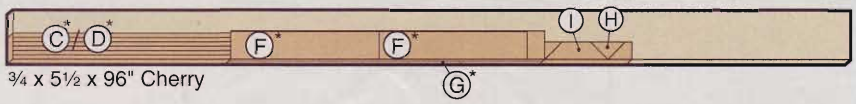
cutting diagram



¼ x 24 x 24" Hardboard



¾ x 5½ x 96" Cherry *Plane or resaw to the thickness listed in the Materials List.

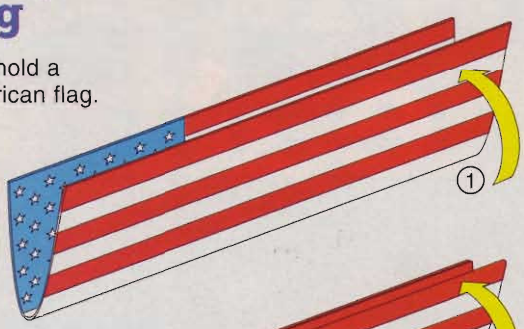


¾ x 5½ x 96" Cherry

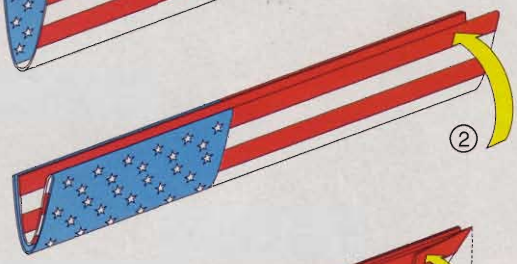
The correct way to fold the American flag

Our flag case is shaped to hold a properly-folded 5x9½' American flag. Here's how it's done.

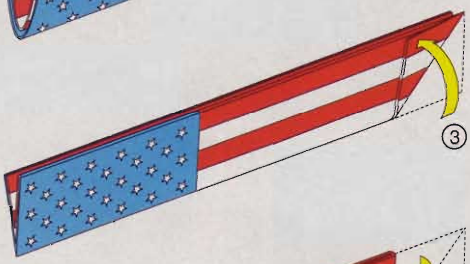
Step 1
Fold the flag in half. You now have open and closed edges.



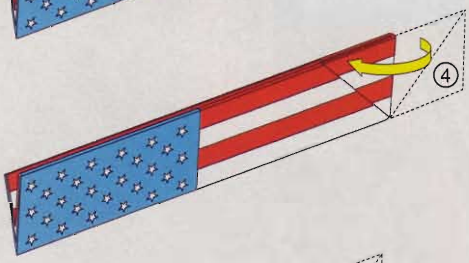
Step 2
Fold in half again toward the open edge.



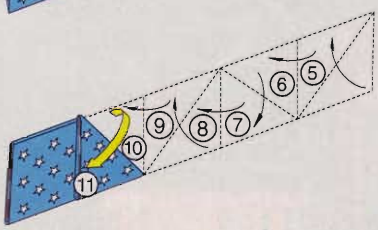
Step 3
Fold the closed corner toward the open edge, forming a triangle.



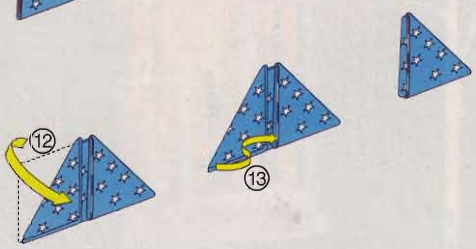
Step 4
Fold the point of the triangle toward the blue field.



Steps 5–11
Continue folding until you have one square of the field left.

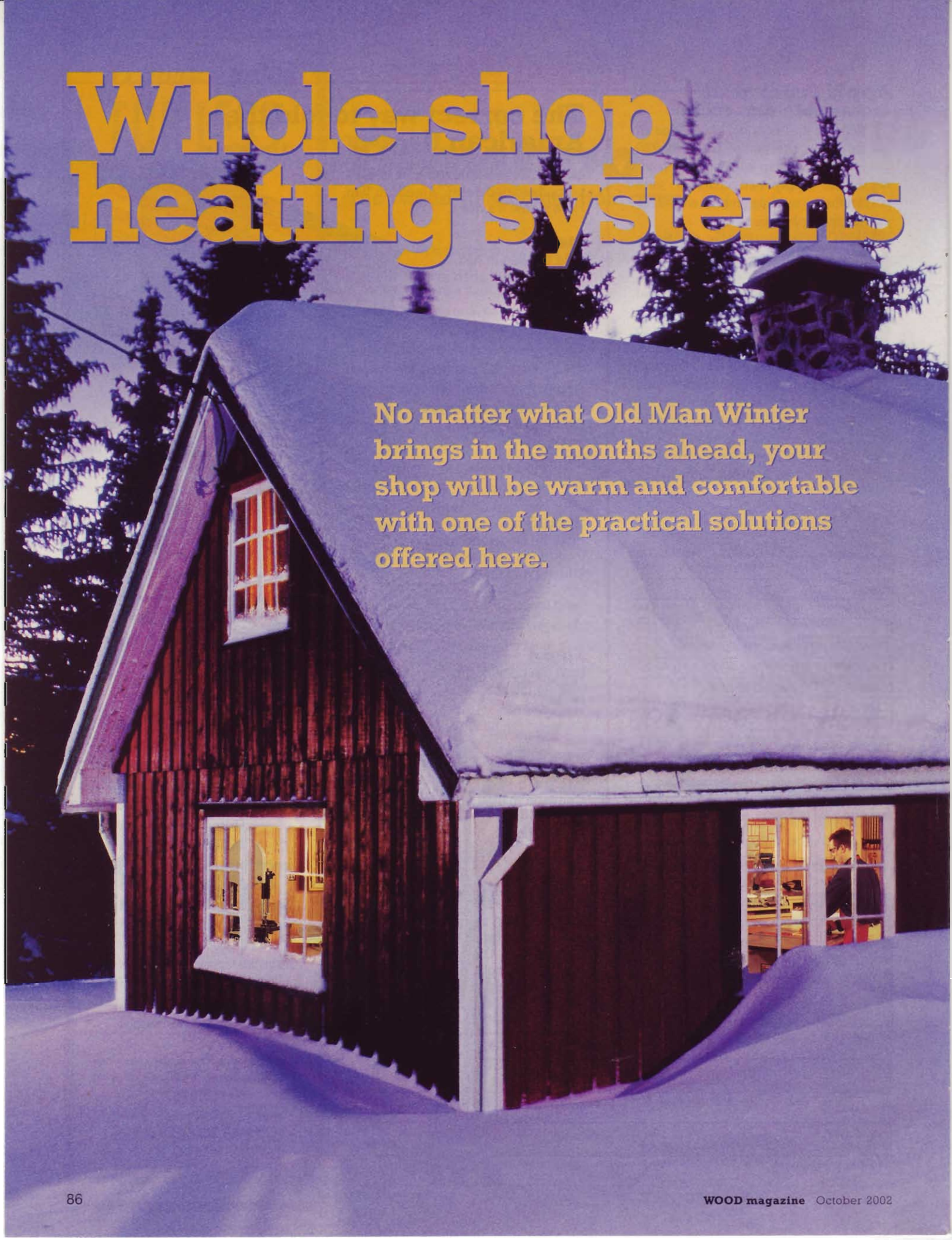


Steps 12–13
Fold the open corner of the square toward the closed edge. Tuck the resulting triangle into the rest of the flag.



Whole-shop heating systems

No matter what Old Man Winter brings in the months ahead, your shop will be warm and comfortable with one of the practical solutions offered here.



We woodworkers love the winter, when outdoor chores end and nasty weather drive us indoors to where we wanted to be in the first place—our workshops. But if our shops lack heat, we could be sidelined for much of the woodworking season.

To fix the problem, many people turn to portable space heaters for warmth. But these units often are marginally effective at best. For real comfort, consider a dedicated shop-heating system.

For about the price of a good cabinet saw, say $1,500, you can buy the components to heat a 24×24' workshop. You might even find a used appliance for a fraction of that cost by checking with local heating contractors. Professional installation will cost in the range of 20–30 percent more. Here are some smart, widely-available options. (For a quick overview of the types, see the chart and sources at the end of the article.)

Burning issues

Shops share some of the same heating concerns as homes, but significant differences exist, as well. Keep the following in mind as you plan a heating system.

■ **Insulation:** You can't bring warmth effectively in until you keep the cold out by sealing and insulating your shop. The up-front expense is small compared to what you'll save in the long run.

This difference is easy to see looking at heating requirements, figured in British Thermal Units (BTUs) per hour. For a 24×24' shop in the upper Midwest, where winter temperatures dip below 0 degrees Fahrenheit, manufacturers quote an average of about 25,000 BTUs per hour for an insulated shop, and more than 50,000 for one without insulation.

■ **Air quality:** Fill the air in your shop with enough fine sawdust or finishing fumes, and you'll have the potential for an explosion. So stay away from open-flame heaters and from electric units with exposed heating elements. Choose a unit that, if electric, has shielded elements, or, if gas-powered, draws outside air for combustion rather than shop air.

■ **Insurance and permits:** Before you install a heating system, check out local code requirements governing the types of heaters you can use, installation restrictions, and required permits. Talk to your insurance company, as well. Skirting these steps could lead to fines, or to denied claims if you have a fire—even one unrelated to the heating system, such as one caused by improperly discarded finishing rags. (You always lay your oily rags out to dry flat, right?)

■ **Unique requirements:** Differences in climate, construction, and usage dictate different heating needs in every shop. Check out "A heated debate," on *page 90*, for more individual considerations.

The old reliable: a gas-fired, forced-air furnace

Forced-air heaters fall into a couple of categories: Self-contained heaters that mount to the wall or hang from the ceiling and the traditional ducted furnace, found in many homes.

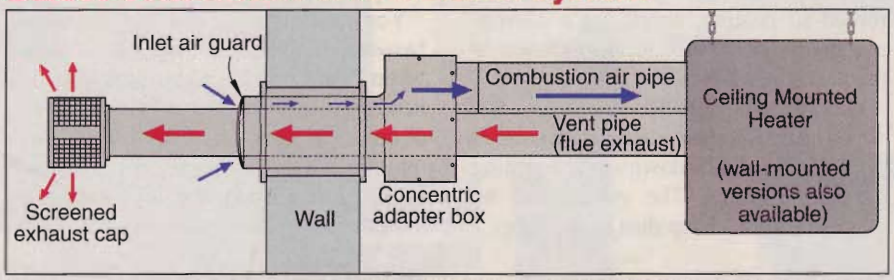
Self-contained heaters, such as the model shown in the photo, *right*, have been standard issue in shops and garages for years. They don't eat floor space, and are relatively easy to install because they don't require ducting. These heaters produce heat from economical liquid propane (LP) or natural gas. Most circulate warmed air using a fan. Unlike older versions, some modern units draw combustion air from the outside, as shown in the drawing, *below middle*.

A traditional furnace distributes air through a series of ducts to just where you want it. Installation involves more challenges, but a furnace also accommodates central air conditioning.

If you choose a furnace that doesn't draw outside air for combustion, install it in a separate room to minimize dust and fume hazards. The drawing, *bottom*, shows one way to do this.

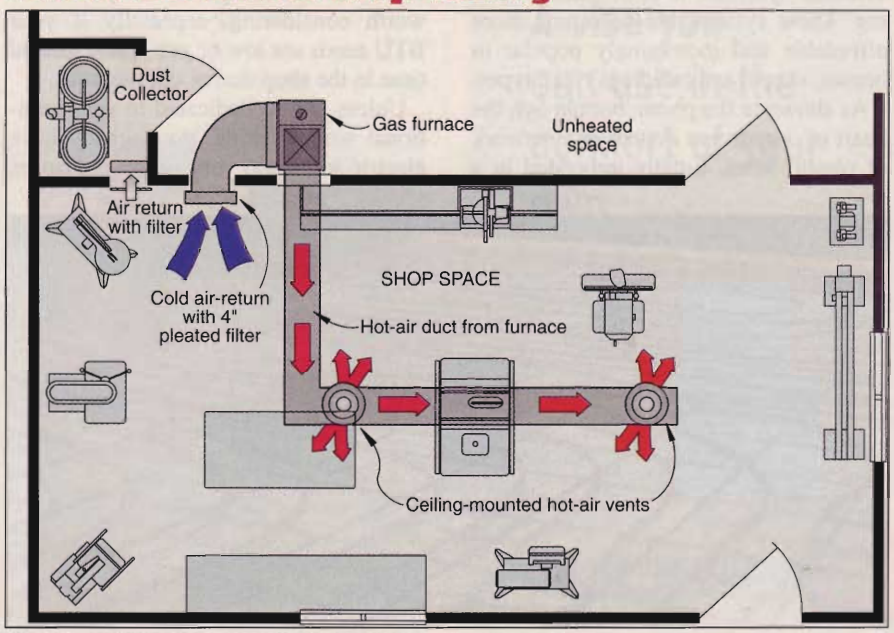
A ceiling-mounted heater, such as this unit from Reznor, installs easily, provided you have access to LP or natural gas.

Direct-vent intake and exhaust system



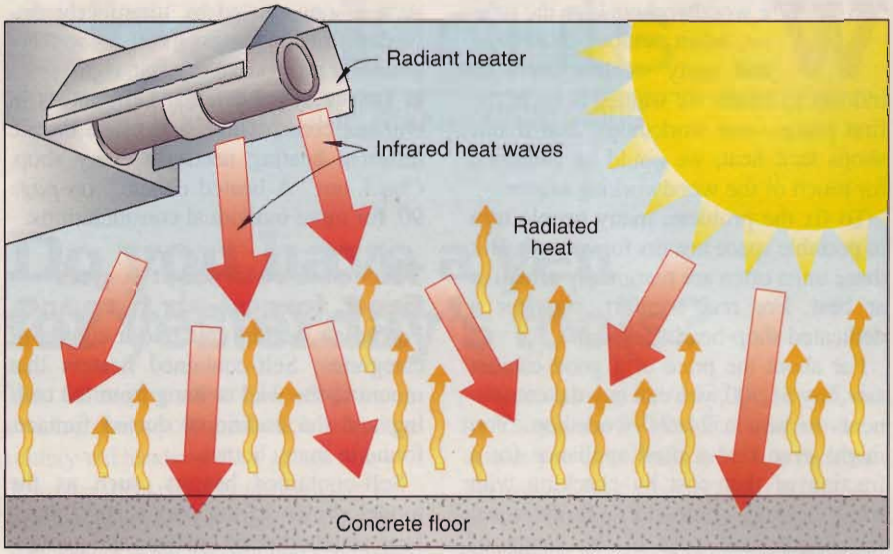
Most direct-vent and separated-combustion heaters feature a 2-in-1 pipe that draws intake air and exhausts waste through a single opening in the wall.

Forced-air furnace shop heating



Locating the furnace in an adjoining, unheated room eliminates potential for a dust or fume explosion. A filtered cold-air return traps shop-generated dust.

Radiant tube heaters, such as this Re-Verber-Ray unit, are available in several sizes, and can be configured in straight, "U" and "L" shapes to fit the space



Just like the sun, radiant heaters warm the objects in the room, such as the floor or any pieces of equipment, which in turn radiate heat back out, warming the air.

Turn on the tube

If you have access to gas, but don't want forced-air heating, check out a ceiling-mounted radiant tube heater, shown in the photo and illustration, *above*.

Tube heaters burn LP or natural gas, which warms the air inside a long metal pipe. Heat radiates downward, warming objects it strikes. The system has no external fan to stir up dust in the shop.

Heat under feet

When building a new shop (oh yeah, it's a "garage," we won't tell), you might consider hydronic, in-floor radiant heating. These systems are becoming more affordable and increasingly popular in homes, shops, and buildings of all types.

As shown in the photo, *bottom left*, the heart of a hydronic system is a network of plastic tubes, usually imbedded in a concrete floor. Hot water pumped through the tubing heats the concrete, which acts as a giant radiator and warms everything above it.

You can power a hydronic system for a two-car-garage-sized shop with a small water heater. (If it's a gas unit, you still need to isolate the flame from shop air, of course.) You can build a "closed" system filled with antifreeze, or run a water supply to the shop and let the heating system provide hot water, as well.

Electric options

Electricity has traditionally been an expensive heat source. Even so, the setup costs with other systems may make it worth considering, especially if your BTU needs are low or you spend limited time in the shop during cool seasons.

Unless you're dedicated to *very* traditional woodworking, you already have electric service to your shop, so chances are you won't need anything more to run an electric heater. Units that run on 220 volts generally produce more heat.

Electric heaters come in many sizes and styles, and it's easy to add more based on need. Portables don't require special insurance, and even permanent units seldom require a permit.

Radiant panels, such as the ones shown *below*, from Radiant Electric Heat, Inc., pass electricity over a large metal plate to produce warmth. These heaters are fairly immune to dust and fume dangers.

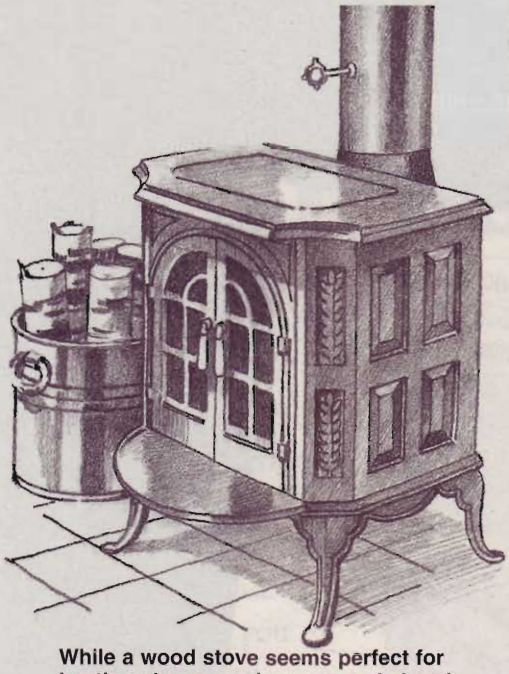
According to the manufacturer, heating with radiant electric panels costs about the same as using a natural gas or LP forced-air system. Electricity costs more per BTU but, because radiant heating warms objects and not just the air, electric panels heat using fewer BTUs

Other electric options include in-floor, ceiling-mounted, and simple "plug-and-play" baseboard units.

Contined on page 90

In a radiant-slab floor, water flows through flexible plastic tubing that gets routed and secured before pouring concrete. Electric in-floor radiant systems exist, as well.

Cove heaters from Radiant Electric Heat, Inc. provide economical radiant heat without taking up much space. Heating large areas requires multiple units.



While a wood stove seems perfect for heating shops, modern gas and electric systems are simpler and safer to use.

Is wood good?

A wood-burning stove seems like the ultimate romantic source of shop heat for many woodworkers. After all, you're making fuel all the time in the form of scraps and (heaven forbid) mistakes. But wood stoves do have drawbacks.

First, those kiln-dried scraps burn up pretty quickly, so you'll need a supply of split firewood. Even with good wood, an inexpensive stove can be hard to regulate, causing wide temperature swings. And unless you make special trips to stoke the fire, you'll lose your heat when not in the shop.

Insurance companies may balk at a stove's open flame and hot surfaces. Also, some communities with strict air standards regulate the use of wood-burning stoves and fireplaces. A stove may look great in the shop, but isn't the safest heat source.

Written by **David Stone**
Illustrations: **Kim Downing**; **Lorna Johnson**; **Roxanne LeMoine**; **Jim Stevenson**
Photographs: **Marty Baldwin**; **Reznor, Inc.**; **Radiant Electric Heat, Inc.**; **Radiant Floor Co.**; **Craig Carpenter**

For additional help with setting up a heating system in your shop, contact a local heating contractor, or take a look at the products offered by these companies:

Detroit Radiant Products Co. (Re-Verber-Ray)
Overhead radiant tube heating systems
800/222-1100/www.reverberray.com

Radiant Electric Heat, Inc.
Radiant electric cove, wall-mounted, and baseboard heating systems. 800/774-4450/www.electricheat.com

Radiant Floor Co.
Hydronic floor heating systems
866/927-6863/www.radiantcompany.com

Reznor, Inc.
Ceiling-mounted, self-contained heating systems
800/695-1901/www.reznoronline.com

A heated debate: Deciding how many BTUs you should use

Whatever type of heating system you choose, answer these questions before you shop. Discuss the answers with a heating contractor or salesperson to ensure that you select the size and type of system that best suits your needs.

1. Does your shop stand alone or is it attached to another heated structure?

2. How many exterior walls does your shop have, and are they currently insulated?

3. Is it a dedicated shop, or a space also used for a garage or other purposes?

4. What are the shop dimensions?

5. How high are the ceilings?

6. What construction materials make up your shop (wood, brick, concrete block, etc.)?

7. Do you know the insulation values in the walls and ceiling?

8. How many windows does the shop have, and are they single-pane or high-efficiency units?

9. How many exterior doors are there?

10. Does the shop have overhead garage doors? If so, are they insulated?

11. How many hours per week do you spend in the shop during cold seasons?

12. When not in the shop, will you heat it to at least above freezing?

13. Do you have a gas line near the building, or will you have to run one?

Shop Heating Systems at a glance

Type	Available BTU range	Unit Cost	Installation Cost	Operating Cost	Pros/Cons
Conventional forced-air furnace	25,000–100,000	Moderate/high ($1,500–$3,000)	Moderate/high ($800–$1,500)	Low/moderate	• Available in a range of styles and prices. • Requires gas line, ducting, and venting. • May dry out shop air and stir up dust. • Requires isolation of flame from shop air. • Ducting can be used for air conditioning.
Self-contained forced-air heater	30,000–125,000	Moderate ($800–$1,200)	Moderate ($400–$800)	Low/moderate	• Available in a wide range of sizes. • Requires gas line and venting. • May dry out shop air and stir up dust. • Requires isolation of flame from shop air. • Units with fans may be noisy.
Overhead radiant tube heater	25,000–50,000	Moderate ($750–$1,100)	Low/moderate ($250–$1,000)	Low	• Not distributed as widely as other systems. • Requires gas line and venting. • Can interfere with overhead garage doors. • Requires ceilings at least 8'-high. • Not available in low-BTU sizes.
Hydronic floor heater	5,000–100,000	Moderate/high ($900–$1,500)	Low/moderate ($300–$500*) *Not including concrete slab	Low	• Provides even heating throughout space. • A small gas or electric water heater can power most shop-sized systems. • Can provide hot water, if desired. • Requires new construction or new floor.
Electric heater	500–2,500	Low ($75–$500)	Low ($0–$500)	Moderate/high	• Many styles available in home centers. • Easy to install: plug in or hard-wire. • Portable models can be expensive to operate. • Effective in low-BTU-need regions. • Requires ganging small individual units.

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(By Frank K. Wood)

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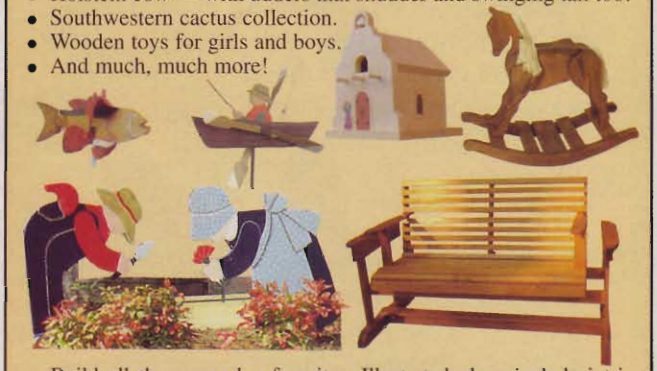

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shop-proven products

These woodworking wares passed our shop trials

DeWalt's multi-base router kit gets it right

I have a personal rule against buying multi-anything tools because each function typically compromises the others. DeWalt's new DW618PK multi-base router kit is an exception to the rule.

The heart of the system is the fixed-base DW618K, boasting soft-grip handles and a 2¼-hp, soft-start, electronic variable-speed motor. That removable motor also snaps into a matching plunge base or D-handle base. I cut some hefty mortises using the plunge base and detected no hint of strain from the machine.

DeWalt DW618PK

Performance	★★★★★
Price	$250 (fixed-base & plunge kit) $190 (fixed base router only) $80 (D-handle base only)
Value	★★★★★

Call DeWalt at 800/433-9258, or visit www.dewalt.com.

Instead of rotating the motor in the fixed base to adjust the height, the DW618K's twist ring smoothly threads the motor up and down without rotating it. That means the power switch stays in one place: within easy reach of your thumb. In a thoughtful nod to left-handed users, DeWalt engineers designed the motor so you also can mount it with the switch on the left side.

Speaking of user-friendly engineering, the DW618K's detachable power cord makes the changeover to the D-handle base hassle-free. Simply twist the base of the cord to remove it from the motor, plug it into the base on the handle, then plug the D-handle's short cord into the motor, as shown *above*.

The true test of a multi-base kit is its plunge base, and this one proved fluid-smooth and steady. It also has through-the-plunge-post dust collection, which effectively cleared the chips from even deep mortises. My only gripe about the plunge base is that the beefy depth-stop rod hides a fair amount of the depth scale.

Almost as impressive as the performance is the number of accessories that come with the DW618PK. In addition to the fixed and plunge bases, the $250 kit includes a carrying case, ¼" and ½" self-releasing collets, two clear Lexan subbases (one that accepts Porter-Cable-style guide bushings, and one with a larger 2½" bit opening), and a neat concentricity tool—the cone-shaped gadget in the foreground of the photo—that centers the subbase (or your router table insert plate) over the collet.

The fixed-base router also comes in a 1¾-hp, fixed-speed configuration (model DW616K) for $30 less. It's also available in kit form with plunge- and D-handle bases.

—Tested by George Granseth

Continued on page 100

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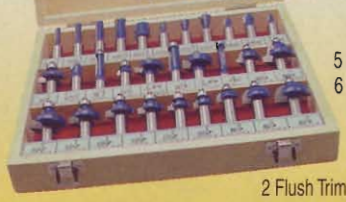
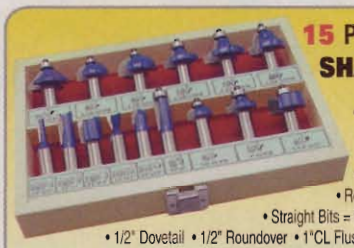


Includes:
5 Straight Bits
6 Roundovers
3 Dovetails
3 Core Box
3 Cove Bits
2 Flush Trim, 1 Panel Bit
2 Roman Ogee, 2 slot cutters, 1 "V" Groove
1 Chamfer and 1 Bevel Trim Bit **SUPER BUY**

WL-2010 **OUR PRICE *ONLY* $109 set**

15 Piece 1/2" SHANK SET



Includes:
• Chamfer • Cove = 1/2"R, 3/8"R, 1/4"R
• Roundover = 1/2"R, 3/8"R, 1/4"R
• Roman Ogee = 1/4"R
• Straight Bits = 3/4"R, 1/2"R, 1/4"R
• 1/2" Dovetail • 1/2" Roundover • 1°CL Flush Trim • Rabbet Bit

WL-2022 for 1/2" *or* WL-2021 for 1/4"SHANK SET
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5 Piece DOVETAIL SET

• 14° 3/4" • 14° 5/8"
• 8° 1/2" • 14° 1/2"
• 14° 3/8"
1/2" Shank Router Bits
WL-2017
$30 VALUE
OUR PRICE ONLY $19 set

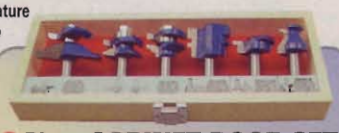
8 Piece PICTURE FRAME SET

Perfect for making great looking picture frames. Bits can be combined to form complex mouldings or simple decorative frames.

WL-2008 $189 VALUE
OUR PRICE ONLY $75 set

3 Piece CABINET DOOR SET

1/2" Shank Router Bits • 2-pc Roman Ogee Rail & Stile • 3 1/4" Panel Raiser
WL-2019-1 $129 VALUE
OUR PRICE ONLY $75 set



6 Piece CABINET DOOR SET

1/2" Shank Router Bits
• 2-pc Rail & Stile (Roman Ogee) • Drawer Lock
• 3 1/4" D Panel Raiser (Ogee) • Door Lip • Glue Joint
WL-2020-1 $175 VALUE
OUR PRICE ONLY $119 set

5 Piece CABINET DOOR SET

3/4" Bore Shaper Cutter
• 1-pc Rail & Stile (Roman Ogee)
• 4 5/8" Panel Raiser (Ogee)
• Door Lip
• Glue Joint
• Drawer Lock
WL-1505 $279 VALUE
OUR PRICE ONLY $179 set

5 Piece MOULDING SET

1/2" Shank Router Bits WL-2011 $175 VALUE
OUR PRICE ONLY $99 set

13 Piece DOVETAIL SET

1/2" Shank Router Bits
• 3 Straight Bits
• 10 Dovetail Bits
WL-2014
$125 VALUE
OUR PRICE ONLY $49 set

9 Piece MASTER DADO SET

Includes Undersize for Plywood, Standard for Hardwood and Oversize for Melamine or Veneered Materials In 3 Popular Sizes: 1/4", 1/2" and 3/4".

WL-2030
$89 VALUE
OUR PRICE ONLY $49 set

5 Piece COVE SET

1/4"R • 3/8"R • 1/2"R • 5/8"R • 3/4"R
WL-2015 $99 VALUE
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1/2" Shank Router Bits

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Eliminate bandsaw tension headaches

Bandsaw manufacturers recommend relaxing the tension on your bandsaw blade between jobs, but few of us do because it's a pain. Carter's Quick Release Bandsaw Blade Tension Toggle is just the tonic to relieve that pain.

Fitting 14" bandsaws from Craftsman, Delta, Jet, and Ridgid, a pull of the Quick Release lever slackens all blade tension; pushing the lever back up instantly retensions the blade. Installation requires disassembling the saw's tensioning mechanism, drilling mounting holes with the bit that comes with Quick Release, and reassembling the tensioning mechanism.

If you change blade sizes, you'll still have to retension for the new blade. Quick Release helps here, too. I found that I could center the new blade on the wheels, temporarily tension the blade by lifting (not locking) the lever, then spin the blade by hand to check tracking.

At a price of $150, Quick Release may not be for the economy-minded woodworker. But, if you have limited hand strength, or want to maximize the life of your bandsaw and blades, you'll find it money well spent.

—Tested by Jeff Hall

Quick Release Bandsaw Blade Tension Toggle

Performance	★★★★★
Price	$150
Value	★★★☆☆

Call Carter Products toll-free at 888/622-7837, or visit www.carterproducts.com.

Continued on page 110

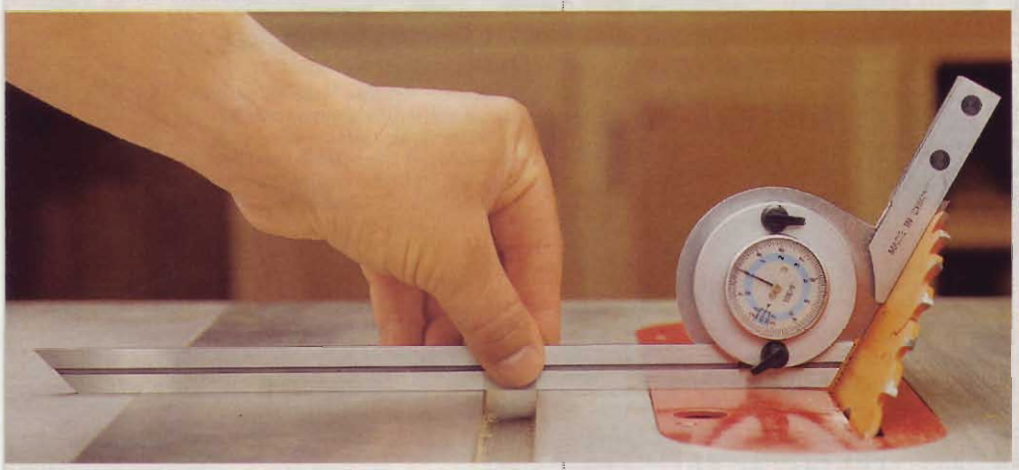
Protractor angles for position with precision

I was skeptical when I saw Grizzly advertising a dial protractor for only $40. That's why I was pleasantly surprised to find the angle-setting gauge dead-on accurate at every angle I measured with a set of machinist's precision angle blocks.

You can use the G9900 Dial Protractor to measure an unknown angle by matching the beam and blade to the workpiece and locking them in. Or, if you're trying to set up a machine fence, table, or blade to a specific angle, first lock in the angle on the protractor and set the machine to match it.

The G9900 Dial Protractor's large face is marked in 5-minute (1/12°) graduations—plenty accurate for any woodworking task. For measuring angles smaller than 11°, an acute angle attachment (not shown) attaches to the beam.

—Tested by Garry Smith



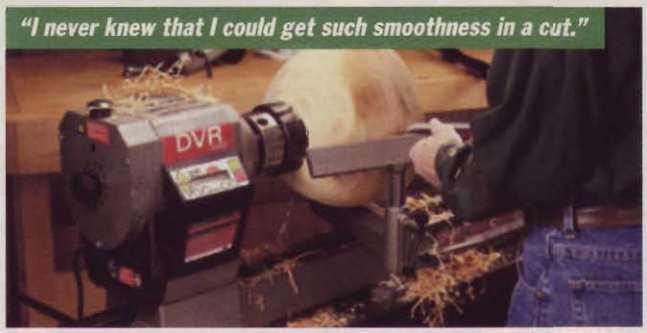
Grizzly G9900 Dial Protractor

Performance	★★★★★
Price	$40
Value	★★★★★

Call Grizzly Industrial at 800/523-4777, or visit www.grizzly.com.

About our product testers

George Granseth *runs the architectural millwork program at a community college.* **Jeff Hall** *teaches woodworking and other technical skills to high-school students.* **Garry Smith** *is a machinist. All are avid woodworkers.*



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It's driven like nothing else before it, and it turns like nothing else you've ever experienced.

The new NOVA DVR 3000 lathe is built around an exclusive beltless magnetic pulse drive motor that provides higher torque, 100% energy transfer, and digital speed control - all housed completely in the headstock. It actually senses and responds to your turning.

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what's ahead

A sneak peek at the November issue of *WOOD®* magazine (on sale October 15)

Projects for your home, shop, and holiday gift giving

One-day workbench

Add storage and work surfaces to your shop with a minimal investment in time and materials.

Child's desk

Here's the perfect complement to the bunk beds and dresser found in this issue.

Pendulum doll cradle

Want a big hug from that special little girl in your life? Here's just the ticket.

Festive decorations

Add a craftsman's touch to your home's holiday atmosphere with this winter scene and ornaments.

Hall bench and coatrack

Build one or both of these matching traditional home accents.

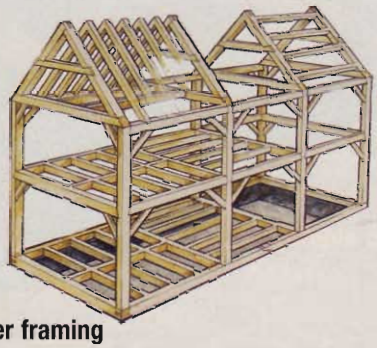
Arched candle holder

A few scraps of wood are all you need to build this classy centerpiece.

Tools, Techniques & Features

Get your money's worth in a random-orbit sander

There's no sander more useful than one with random-orbit action. We tested a baker's dozen to see which ones work best.



Timber framing

Rough carpentry and precision woodworking come together in this time-honored home-building approach.

Rub out your finishing headaches

Apply your favorite finish, then use these rubbing-out techniques with fine abrasives to remove imperfections and achieve a dazzling sheen.